ORIGINAL

TEN-TEC SERVICE NOTE SN-2-262

Subject: Erratic VOX Operation in High RF Fields.

We have had a number of field reports of erratic or distorted VOX operation when using the Model 262G Power Supply with the TRITON transceiver. The problem is more prevalent when high power linears are used, although some TRITONs running barefoot showed similar problems. In every case, running the transmitter into a dummy load did not show any symptoms of malfunction. Hence the cause of the erratic operation was traced to RF energy feeding back into the VOX circuits.

Although this type of problem is not easily solved with a single modification, since each setup is unique in the strength and mode of RF pickup, the following suggestions were found to be helpful in reducing, if not completely eliminating the problem. One or more of them may be of help to you.

EXTREMELY IMPORTANT

1.) Rearrange the grounding system. Make sure that the chassis of the power supply is tied to the TRITON chassis and to a good earth ground. Lugs on the rear panels of the units are provided for this. Use heavy wire or shield braid such as that obtained from a piece of RG-8/U cable.

2.) Locate any source of high RF as far from the TRITON and Power Supply as possible. Such items as antenna tuners and matching sections should be well shielded and remote from the transmitting equipment. Open wire feed lines are also sources of high RF in the shack.

3.) Use a good RF line filter on the AC coming into the shack and especially on the line to Model 262G. Ground the by-pass capacitors in the filter to a good earth ground.

4.) Add .01 mfd, 1000 volt ceramic capacitors from each side of the AC line to the Model 262G chassis where the line feeds into the chassis. (This has been added to production units made after April 20, 1976.)

5.) Replace the zip cord type speaker cable used in early models of the Model 262G with a shielded lead. Try grounding the shield first at the TRITON speaker plug only and then at the Power Supply chassis only, and finally at both locations. Use the grounding location that proves best. (Production after April 20, 1976 has shielded cable.)

6.) If headphones are used, place a .01 mfd capacitor across the phones, either in the phone plug or at the phone jack on the TRITON (AUDIO jack) or Model 262G (PHONES jack).

7.) Try shielding the power cable from the Model 262G to the TRITON. Again try grounding the shield at either end to find best location. (A quick check to see if this step will help is to wrap the cable in aluminum foil and ground the foil.)

8.) Check microphone cable to see that it is well shielded. (Some spiral wrapped shielding is not a good RF shield. Braided shield is preferred.) If PTT lead is outside of shield, try cable that has this lead within the shield. (Again, aluminum foil wrapped tightly around the mike cable and grounded will indicate if this step will help.)

9.) If you find that by advancing the VOX GAIN control the delay circuit does not hold the transmitter on for the intended period of time, but rather goes into a transmit/receive mode with each syllable, the addition of a 0.1 mfd capacitor from the collector of Q4B to ground on the VOX PC assembly should correct this. The small capacitor can be tacked to the bottom pattern of the board, using short leads and tubing on the leads to prevent shorts. (Production units after April 20, 1976 have this addition.)

10.) In earlier model TRITON IVs, the PTT jack on the rear panel did not have a by-pass capacitor to chassis. This capacitor, a .01 mfd, should be added if unit does not have it. Also, the three ground lugs on the phono jacks marked PTT, KEY and SIDETONE should have wires run between them and also be gfounded to the chassis pan under them. It may be necessary to drill a small hole in the chassis to attach a GND lug. Use same lug to ground one lead of .01 mfd bypass. Cther lead connects to center terminal of PTT jack.

11.) Using a quarter wavelength of single conductor wire for the offending band or bands, connect as a counterpoise to the ground lug of the antenna tuner, power supply, or transceiver. Do not coil, but effectively loop this counterpoise along the rear apron area of equipment. Do <u>not</u> connect other end to ground or any other terminal.

12.) Place a .01 mfd capacitor from the hot mike input to the adjacent ground pin on the VOX Board 80230.

TEN-TEC MODELS 251 + 252G POWER SUPPLIES

GENERAL

The TEN-TEC Model 251 Power Supply will deliver up to 9 amperes at approximately 13 VDC, regulated, from a 117 VAC 50-60 Hz source. An electronic latching circuit breaker shuts down the output voltage when a current in excess of 10 amperes is drawn from the supply. Reset is accomplished by cycling the POWER switch. Two indicator lamps monitor the LINE and OUTPUT voltages. The primary circuit is fused with a slo-blo fuse. The output voltage is available through a six pin Jones connector and a phono type jack for low current applications. Two of the six Jones pins are used for remote power on-off switching, if desired.

The Model 252G is similar to the Model 251 except that it will deliver up to 18 amperes at approximately 13 VDC. The circuit breaker in this model is factory set to trip at 20 amperes, and the line fuse rating is twice that of the Model 251. Either model will accept Model 207 Ammeter.

The circuit consists of a bridge rectifier, followed by a high capacitance filter. This, in turn, is followed by a series type transistor regulator whose base voltage is derived from a three transistor regulator. The "crow-bar" type circuit breaker consists of a SCR which removes the base voltage from one of the regulator transistors when fired. The SCR signal is developed across a low value sampling resistance in series with the load.

INSTALLATION

1.) Output Cables and Connectors - The high current output should be drawn from the six pin Jones connector. Pins 3 and 4, the two vertical center pins are negative GND, and are marked on the chassis with a -sign. Pins 5 and 6, the two vertical pins nearest the end panel and marked +, are the positive terminals. Pins 1 and 2 are connected in series with the POWER switch and are used with a remote on-off switch, if desired. If the supply is to be turned on and off only by the front panel switch, pins 1 and 2 should be jumpered together in the plug. The unit will be inoperative without this jumper, or if the plug is removed from the socket. Keep interconnecting cables carrying the high current as short as possible, and of a wire gauge greater than, or equal to #14. Sizable cable voltage drop will be experienced with long cables and/or small wire sizes. Always jumper the two pins available for the minus together and the two for the plus, to reduce pin resistance to a minimum.

   Provide a good interchassis connection by running a separate heavy braid or stranded wire between them, using the ground lug terminal provided near the output connectors. In rf communication systems, a connection from chassis to a good earth ground is also recommended.

   The phono jack marked AUX. 12V is connected in paralled with the output from the Jones socket and may be used to power auxiliary equipment that does not draw more than 1 ampere. Center terminal is positive, shell is negative.

2.) Models 251/E and 252G/E - These models have a dual primary winding on the power transformer, permitting operation from either 115 or 230 VAC. They are factory wired for 230 volt operation and do not have plugs on the line cords. To change from 230 to 115 volt primary, see instructions printed on the inside cover of the supply.

3.) Model 207 Ammeter - The upper phono jack marked AMMETER accepts the cable attached to the Model 207 Ammeter. This meter utilizes the internal shunt resistance of the supply and because of this, requires no alteration when used with either the 9 or 18 ampere supply. Just read the appropiate scale.

OPERATION

1.) Connect line cord to proper source of voltage, and load to output connectors as described above.

2.) Turn unit on by pressing the push POWER switch. The two lamps should indi-

cate that both LINE and OUTPUT voltages are present. If OUTPUT lamp does not light, check load and cables for short or excessive current situation.

3.) If the load current is variable, some dimming of the LINE lamp may be observed. The OUTPUT lamp, however, monitors the regulated voltage and should not dim with current drains up to rated values. If pilot lamps in the driven equipment dim with increased load current, but OUTPUT lamp does not, it is an indication that a loss of voltage to the load is present in the cables. To remedy, use shorter cables and larger wire size.

4.) To reset the circuit breaker after it shuts down the OUTPUT voltage, as monitored by its pilot lamp, turn unit off and wait approximately three seconds. Then switch unit on again. If the short or overload remains, the breaker will again shut the unit down. Remove cause of overload and reset as before. It is necessary to wait several seconds to allow the circuit capacitors to discharge sufficiently for proper resetting.

5.) Fuses - In the event that the line fuse blows, replace with an identical type Slo-Blo.

Model 251 - 115 VAC operation: 2A.
Model 251/E - 230 VAC operation: 1A.
Model 252G - 115 VAC operation: 4A.
Model 252G/E - 230 VAC operation: 2A.

6.) Do not place power supply in a small volume where normal room air cannot reach the heat sink mounted on the rear panel. This heat sink should have free access to normal convection air currents. When operating the supplies near rated full load for relatively long periods of time, the heat sink will become very warm, and in the case of the Model 252G can approach temperatures of approximately 200° F. If extended operation is anticipated and/or the line voltage is above the mean values or 115 or 230, it is recommended that a small fan be used to circulate air around the heat sink fins. For normal CW or SSB Amateur communications applications, where the duty cycle is no greater than 60%, no extraordinary precautions need be taken in this regard.

Specifications Common to Models 251 & 252G

Input Voltage: 117 VAC, 50-60 Hz.
Output Voltage: 13 VDC, ± 0.5V. Regulated.
Regulation: Better than 1%, no load to full load @ 117 VAC.
Construction: Aluminum with molded plastic side panels.
Output Connectors: One 6 pin Jones type.
One Phono jack for low current.
One Phono jack for Model 207 Ammeter.

Specifications for Model 251

Output Current: 9 amperes continuous, full load.
10 amperes, maximum.
Circuit Breaker: Electronic latching. Factory set to trip at 10 A.
Ripple: Less than 25 mV, peak-to-peak @ 9 A and 117 VAC.
Size: HWD 4½" x 8¼" x 8".
Weight: 9½ lbs.

Specifications for Model 252G

Output Current: 18 amperes continuous, full load.
20 amperes, maximum.
Circuit Breaker: Electronic latching. Factory set to trip at 20 A.
Ripple: Less than 60 mV, peak-to-peak @ 18 A and 117 VAC.
Size: HWD 4½" x 8¼" x 13".
Weight: 14½ lbs.

TEN-TEC MODELS 261 & 262G POWER SUPPLIES

GENERAL

Ten-Tec Models 261 and 262G Power Supplies are deluxe versions of the Models 251 and 252G supplies, respectively. In addition to the basic supply function of providing regulated DC voltage of approximately 12.5 volts from a 115 volt AC source, these units incorporate a Voice Operated Transmitter (VOX) system of improved design and a large station speaker. Model 261 is intended for use with the Argonaut/ Model 405 Transceiving system, and the Model 262G with the Triton transceiver.

The power supply sections of these units are identical with their 251/252G counterparts, and installation, operating and maintenance information is contained in the Owner's Instructions for these models, which is included in, and a part of these instructions.

The VOX circuit is of an improved design, requiring no anti-vox adjustments. This is accomplished by processing the speech signal through a narrow bandpass active filter centered around 200 Hz. Only this component is used to activate the transmitter. By so doing, practically all of the speech components picked up by the microphone from the station speaker, (which are considerably above 200 Hz), have no effect on the transmitter switching circuits. Only those coming directly from the operator's voice or room sounds, (which do contain 200 Hz components), will activate the T/R circuits. This system also has the advantage that the de-sensitizing effects in the microphone channel, encountered as a result of the anti-vox circuit in ordinary VOX systems, are not present in this system. An adjustable delay control selects the amount of time the transmitter holds in after speech ceases, to eliminate T/R switching between words.

INSTALLATION

1.) Power Connections: See Owner's Instructions for Models 251/252G.

2.) VOX connections:

A.) Insert plug on rear cable marked MIC into the MIC jack on the rear of the Ten-Tec Triton or Argonaut transceiver.

B.) Insert microphone plug into MIC jack on front of the power supply. The microphone plug should be a three contact, (stereo) type of 1/4" diameter barrel. Microphone cable should be well shielded type. Connect shield, (GND), to barrel and microphone signal wire to the band terminal. If a PTT switch is included in the microphone, and occasional PTT operation is desired, connect the PTT switch lead to the ball terminal of the stereo plug. It is recommended that the PTT lead also be shielded to prevent rf pickup. The PTT switch should be of the SPDT type, which shorts the microphone element out in the "receive" position. With this arrangement, the VOX system can easily be disabled by throwing the PTT switch to the "receive" position. Hence no mic signal will be applied to the VOX circuits.

C.) If no PTT switch is incorporated in the mic, or if it is desired that the front panel PTT control switch be used as a "transmit" switch, connect a jumper wire in the phone plug between the ball terminal and ground terminal. This, in effect, enables the PTT front panel control switch to act as a "transmit" switch whenever it is pulled out.

3.) Station Speaker Connections:

A.) If it is desired to use the larger speaker, it is only necessary to plug the cable marked SPEAKER into the PHONES/SPEAKER jack on the rear of the transceiver. It is <u>not necessary</u> that the Model 261/262G speaker be used with VOX operation.

B.) To connect headphones, insert their cable into the jack on the front panel marked PHONES. This will disable the internal speaker.

OPERATION

Front Panel Control Adjustments

DELAY - PTT: With the knob "in", the VOX system is operable. Clockwise rotation of the control increases the delay time after speech ceases until the transmitter circuits revert to the "receive" mode. With normal speech, the time should be adjusted so that the transmitter does not turn off between words. Otherwise some clipping of the first syllables in some words will be noticed. If the microphone incorporates a PTT switch, and it is wired into the circuit as outlined in the section on INSTALLATION, this type of operation can be accomplished by pulling the control knob out. Notice: When using PTT, rotate either the DELAY or VOX-GAIN control fully counterclockwise to defeat the time delay that will occur after switching the PTT switch off. If the microphone plug is wired with a short between the PTT terminal and ground, pulling the knob out will turn the transmitter on. The knob can be used as a station "transmit" switch.

VOX-GAIN: This control only affects the gain of the audio channel that controls the T/R functions. It does not affect the level of the audio signal going to the transmitter, since this is preset for unity gain. Successful VOX performance is directly related to the proper setting of this control. The VOX-GAIN should be advanced just far enough to reliably trip the transmitter on, but not so far that ambient room noises or incidental sounds do. One method of adjustment is to place the microphone twice the normal distance away from the mouth and while talking in the mic, advance the VOX-GAIN control until the transmitter turns on with every word. This is best adjusted with the DELAY control fully counterclockwise. Then, at normal talking distance, the VOX system should work reliably. Advance the DELAY control for "hold-in" between words. For reliable VOX operation, please observe the OPERATING TIPS given below.

VOX Operating Tips

1.) Most reliable operation is achieved when using headphones. Then, VOX-GAIN control setting is less critical.

2.) If speaker operation is desired, use close talking microphone. This also eliminates accidental transmitter turn-on from incidental background sounds.

3.) Maintain largest speaker-to-microphone distance possible. Even though 200 Hz components from speaker are highly attenuated, it is possible that in some instances they are strong enough to trip the VOX system -- particularily when the VOX-GAIN control is advanced.

4.) Advance speaker level only far enough for good copy. Excessive speaker level may trip VOX circuit.

5.) In some instances internal speaker in transceiver may provide better anti-vox performance than large speaker. This may be due to a more favorable speaker-to-microphone placement, or a higher frequency cutoff in the small speaker.

6.) In overly reverberant rooms, use of a unidirectional microphone may improve performance.

7.) DELAY control should be advanced far enough to eliminate syllable clipping on every word.

8.) Speak up into microphone in loud, firm tone.

CIRCUIT DESCRIPTION

The VOX circuit is contained on a single P.C. circuit board which plugs into two 7 pin chassis sockets. Referring to the schematic attached, it functions as follows:

Transistors Q1A, Q1B and Q2 form a very high impedance direct coupled preamplifier, preceeded by an rf filter, R2 and C2. The high impedance input is necessary to preserve the low frequency components from the microphone, especially in the 200 Hz range. Output from this amplifier is taken from the collector of Q2, and is reduced down to unity gain by resistance divider R9 and R10. Output from the divider

is connected to the band terminal of the stereo type phone plug, and thus to the MIC input jack of the transceiver. Transistor Q3A is an electronic switch across this signal line that shorts whenever the T/R line to the transceiver is in the "receive" mode, i.e. when there is a positive DC voltage of from 6 to 13 on the T/R line from the transceiver. This prevents the microphone from being connected into the transceiver receiving circuits, the same as the SPDT push-to-talk switch does when VOX is not used.

The output from the preamplifier is also applied to the VOX-GAIN control via C8 and C10, and then to the two stage active filter consisting of integrated circuit IC-1. The narrow range of output frequencies centered around 200 Hz is converted into two positive going DC voltages by diodes D1 and D2. The voltage from the D2 network is applied to the base of Q4A. Q4A and Q4B make up a bi-stable flip-flop. When the processed audio from the filter is applied as a positive voltage to Q4A, this transistor is turned on, thereby turning Q4B off. When this occurs, the collector voltage of Q4B is at a high state, and this high voltage biases Q3B on. Q3B, when conducting, shorts the T/R line from the transceiver to effective ground, thereby turning the transmitter circuits on. This also results in Q3A becoming an open circuit and thereby permits the microphone signal to be applied to the transceiver MIC input circuit.

The bistable flip-flop will remain in this state, even if the positive base voltage (hence audio from the mic) returns to zero. The flip-flop regains its original state upon application of a pulse to Q4A's emitter from the delay timing oscillator, Q6. This pulse occures after a preset time determined by the charging of C20 through the DELAY control R37 and resistor R32. Q6 is a unijunction relaxation oscillator whose frequency of operation is determined by the RC time constant of C20, R37 and R32. Provided both Q5A and Q5B are in the off state, C20 will start charging toward the +12 volts through the two resistors. When the voltage across C20 reaches approximately 6 volts, the unijunction transistor, Q6, will start to conduct, and discharge C20 through its lower junction and R30 in the emitter of Q4A. The positive pulse across R30 flips Q4A into non-conduction and Q4B into a conducting state. This situation removes the short from the T/R line and places the system back into the receive mode -- until positive voltage is again applied to the base of Q4A. The delay time after speech ceases, then, is controlled by the setting of the DELAY control.

Q5A and Q5B constitute a logic NOR circuit. Both base voltages have to be in the low state before the delay circuitry can function. If either or both bases go positive, the voltage at their common collector will be practically zero, and C20 is prevented from charging and tripping the bi-stable flip-flop back to the receive mode. The base of Q5A senses the state of Q4A, so that the delay circuit will only function when Q4A is conducting, i.e. when the circuit is in the transmit mode. Also, the base of Q5B senses the presence of speech being processed, since its voltage is derived from the rectification of the speech components by diode D1. The delay circuit will not function so long as speech is present in the system. The only logic that will allow the delay circuit to function and provide the "righting" pulse to the bi-stable flip-flop is that speech is not present, and the circuit is in the transmit mode. Only then, after the predetermined delay time, will circuit switch back to the receive mode.

In the event that Q5A and Q5B are both off for a period of time less than the delay time, so that C20 does not reach its firing potential, before speech is again processed to turn Q5B on, it is desirable that the accumulated charge on C20 be quickly discharged so that a full delay time period may be restarted when the NOR circuit allows it. To do this, diode D3 and limiting resistor R35 provide a low impedance path through conducting Q5B to discharge C20. (D3 is back-biased during the normal charging cycle and presents a high impedance to the circuit).

In order to prevent ground loops from the high DC currents in the common ground circuit between transceiver and power supply, the low level VOX microphone circuits are all raised from the supply chassis and grounded only through the cable shield going to the transceiver. To check the circuit performance of the VOX system without having the transceiver connected, it is necessary to provide a ground connection between the cable shield circuit and the supply chassis.

NOTICE: This VOX circuit provides transistor T/R switching for the Ten-Tec line of transceivers. The T/R line requires a positive voltage between 6 and 13 volts in the receive mode and a grounded line in the transmit mode. Impedance of the T/R line should be greater than 1 Kohm. Transceivers with other than these T/R characteristics

cannot be used with this VOX circuit.

SPECIFICATIONS

1.) Power Supply Sections: Refer to Model 251/252G Instructions.

2.) VOX Section:

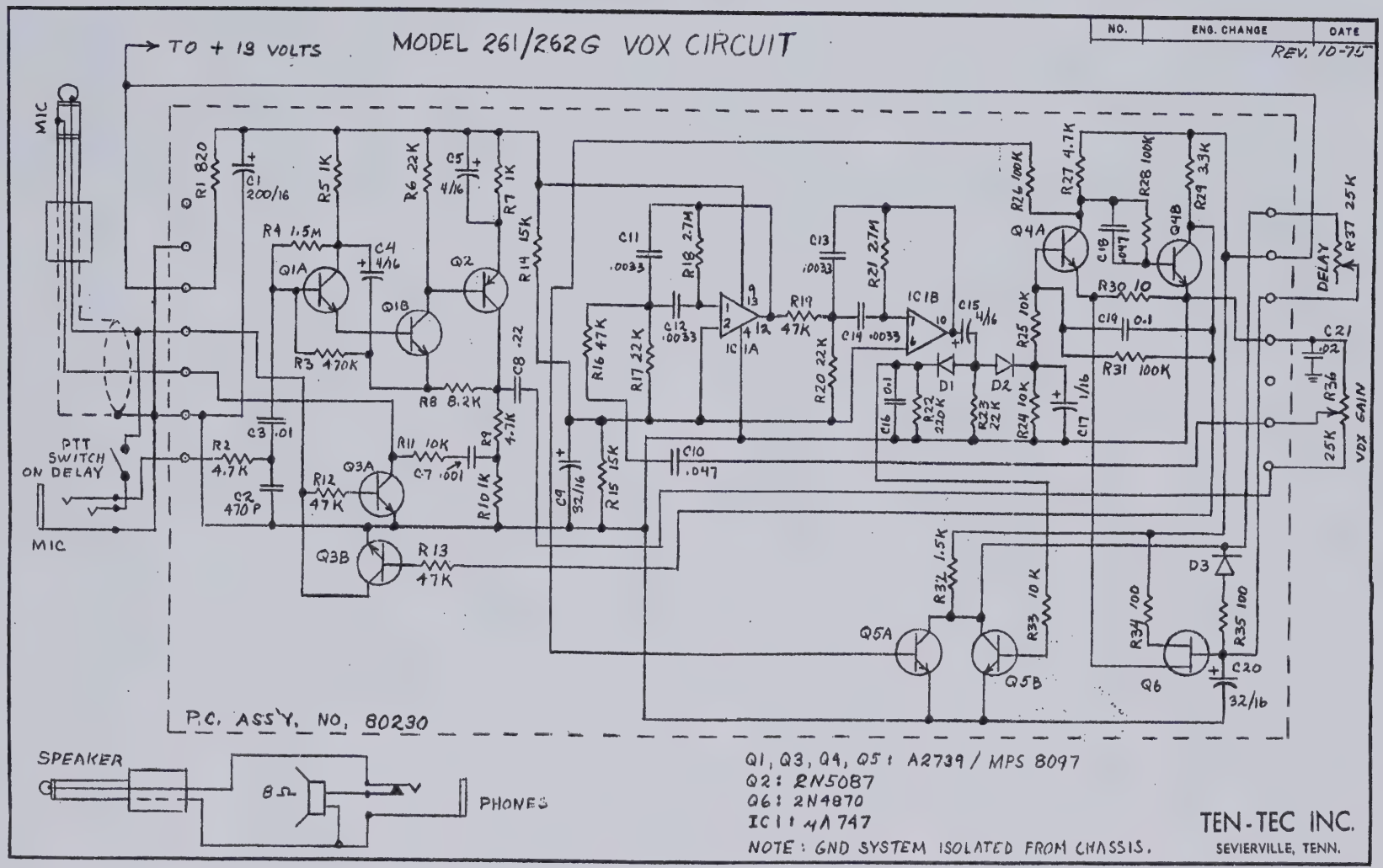
Power Required: 13 VDC @ 8 mA.
Microphone Input Impedance: Greater than 3 Megohms.
Transmitter Microphone Channel Gain: Unity.
Maximum Microphone Input Level: 250 mV.
Sensitivity of VOX Channel: Less than 1 mV @ 200 Hz trips T/R.
Delay: Adjustable from 0.1 to 1.0 sec.

3.) Physical:

Size: HWD 4-1/2" x 9-1/4" x 13"
Weight: Model 261 - 11 lbs.; Model 262G - 14-1/2 lbs.
Construction: Aluminum chassis with molded plastic side panels.

SERVICE and WARRANTY

See Owner's Instructions for Model 251/252G Power Supplies.


MODEL 261/262G VOX CIRCUIT
TO + 13 VOLTS
NO. | ENG. CHANGE | DATE
REV. 10-75
MIC
PTT SWITCH ON DELAY
MIC
R1 820
C1 200/16
R2 4.7K
C2 470P
C3 .01
R3 470K
R4 1.5M
C4 4/16
Q1A
Q1B
R5 1K
R6 22K
C5 4/16
Q2
R7 1K
R8 8.2K
C8 .22
R9 4.7K
R10 1K
C7 .001
R11 10K
Q3A
R12 47K
Q3B
R13 47K
R14 15K
C9 32/16
R15 15K
R16 47K
R17 22K
C10 .047
C11 .0033
R18 2.7M
C12 .0033
IC 1A
R19 47K
C13 .0033
R20 22K
R21 27M
C14 .0033
IC 1B
C15 4/16
C16 .1
D1
R22 220K
R23 22K
D2
R24 10K
R25 10K
C17 1/16
R26 100K
Q4A
R27 4.7K
C18 .047
R28 100K
Q4B
R29 3.3K
R30 10
C19 .1
R31 100K
DELAY
R37 25K
C21 .02
R36 25K
VOX GAIN
R32 1.5K
R33 10K
Q5A
Q5B
D3
R34 100
R35 100
Q6
C20 32/16
P.C. ASS'Y. NO. 80230
SPEAKER
8Ω
PHONES
Q1, Q3, Q4, Q5: A2739 / MPS 8097
Q2: 2N5087
Q6: 2N4870
IC 1: μA 747
NOTE: GND SYSTEM ISOLATED FROM CHASSIS.
TEN-TEC INC.
SEVIERVILLE, TENN.

TEN-TEC MODEL 252M AND 252MO POWER SUPPLY

GENERAL

The TEN-TEC Model 252M Power Supply will deliver up to 18 amperes at approximately 13 volts dc, regulated, from a 117 volt ac, 50-60 Hz source. An electronic latching circuit breaker shuts down the output voltage when a current in excess of 20 amperes is drawn from the supply. Reset is accomplished be cycling the POWER switch. An indicator lamp monitors the OUTPUT voltage. The primary circuit is fused with a slo-blo fuse. Output voltage is available through a four pin AMP connector and phono type jacks for low current applications. Two of the four AMP pins are used for remote power on-off switching, if desired. An ammeter is built in to the front panel.

Electrically, the Model 252M and Model 252MO are identical. Cosmetically, the only difference is the color scheme of the Model 252MO which matches the ⊕MNI.

The circuit consists of a bridge rectifier followed by a high capacitance filter. This, in turn, is followed by a series type transistor regulator whose base voltage is derived from a three transistor regulator. The "crow-bar" type circuit breaker consists of a SCR which removes the base voltage from one of the regulator transistors when fired. The SCR signal is developed across a low value sampling resistance in series with the load, and adjustment is made with a trimpot connected across this shunt. (R8)

INSTALLATION

Output Cables and Connectors: The high current output should be drawn from the four pin AMP connector. Pin 1 is GND negative, and identified by the rib on the plastic portion of the cable connector. (There is a rib on the + terminal of the chassis connector.) Pins 2 and 3 are connected in series with the POWER switch and are used with a remote on-off switch, if desired. Pin 4 is +13 volts.

If the supply is to be turned on and off only by the front panel switch, pins 2 and 3 should be jumpered together in the cable plug. The unit will be inoperative without this jumper, or if the plug is removed from the socket. Keep interconnecting cables carrying high current as short as possible and of a wire gauge greater than, or equal to #14. Sizable cable voltage drop will be experienced with long cables and/or small wire size.

Provide a good interchassis connection by running a separate heavy braid or stranded wire between them, using the ground lugs provided on the rear panels. In rf communication systems, a connection from chassis to a good earth ground is also recommended.

The phono jacks marked AUX 12V are connected in parallel with the output from the AMP socket and may be used to power auxiliary equipment that does not draw more than one ampere. Center terminal is positive, shell is negative.

Model 252 M/E: This model has a dual primary winding on the power transformer, permitting operation from either 115 or 230V ac. It is factory wired for 230 volts and does not have plugs on the line cord. To change from one voltage level to the other, see instructions printed on the label on the inside of the supply.

OPERATION

1.) Connect line cord to proper source of voltage. This is a three wire cable and the green center conductor should be connected to the mains ground system. It is internally connected to the supply chassis.

2.) Connect load to AMP connector as described above.

3.) Turn unit on by pressing the push POWER switch. The meter and OUTPUT lamps should indicate that both line and OUTPUT voltages are present. If OUTPUT lamp does not light, check load and cables for short circuit or excessive current situation.

4.) If load current is variable, some dimming of the meter lamp will be observed. The OUTPUT lamp monitors the regulated voltage and should not dim with current drains up to rated values. If pilot lamps in the driven equipment dim with increased load current, but OUTPUT lamp does not, it is an indication that a loss of voltage is present in the cables. To remedy, use shorter cable and larger wire size.

5.) To reset the circuit breaker after it shuts down the OUTPUT voltage, as monitored by the pilot lamp, turn unit off and wait approximately three seconds. Then switch unit on again. If the short or overload remains, the breaker will again shut the unit down. Remove cause of overload and reset as before. It is necessary to wait several seconds to allow the circuit capacitors to discharge sufficiently for proper resetting action.

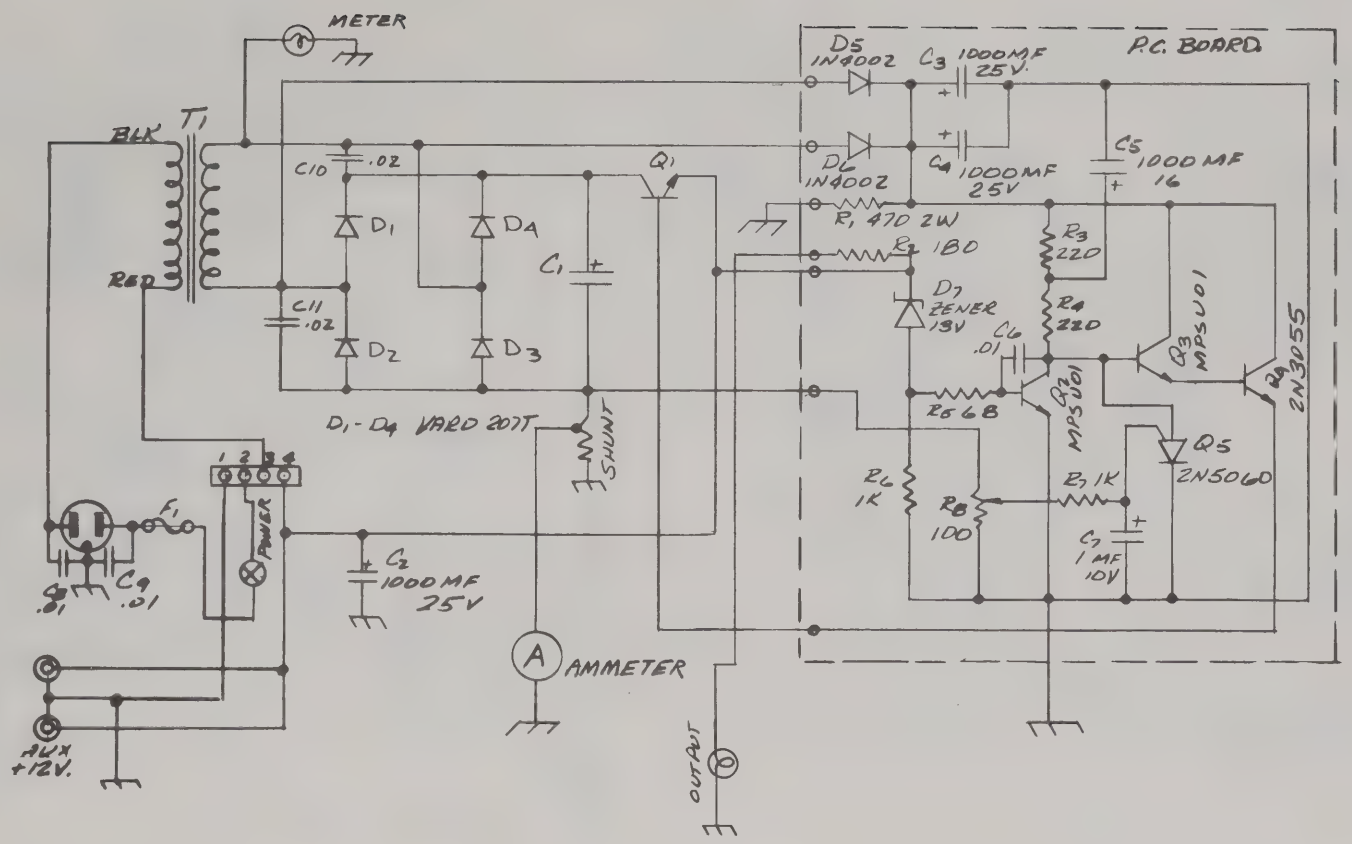
6.) Fuses: In the event that the line fuse blows, replace with an identical type slo-blo.

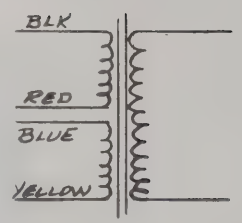
Model 252M and 252MO - 115V ac operation: 4 A.
Model 252M/E and 252MO/E - 230V ac operation: 2 A.

7.) Do not place power supply in a small volume where normal room air cannot reach the heat sink on rear panel. This heat sink should have free access to normal convection air currents. When operating near full rated load for relatively long periods of time, the heat sink will become very hot and can approach temperatures of approximately 200° F. If extended operation is anticipated, and/or line voltage is above mean values of 117 or 230, it is recommended that a small fan be used to circulate air around the heat sink. For normal cw or ssb Amateur operations, where duty cycle is no greater than 60%, no extraordinary precautions need be taken in this regard.

SPECIFICATIONS

Input Voltage: 117V ac, 50-60 Hz.
Output Voltage: 13V dc, ± 0.5V. Regulated.
Regulation: Better than 1%, no load to full load @ 117V ac.
Construction: Aluminum chassis with molded plastic side panels.
Output Connectors: One four pin AMP MATE-N-LOK. Two phono jacks for low current.
Output Current: 18 amperes, full load. 20 amperes, maximum.
Circuit Breaker: Electronic latching. Factory set to trip at 20 A.
Panel Meter: 0-25 amperes.
Ripple: Less than 60 mV peak-to-peak @ 18 A. and 117V.
Size: HWD 4-1/2" x 8-1/4" x 13"
Weight: 14-1/2 lbs.





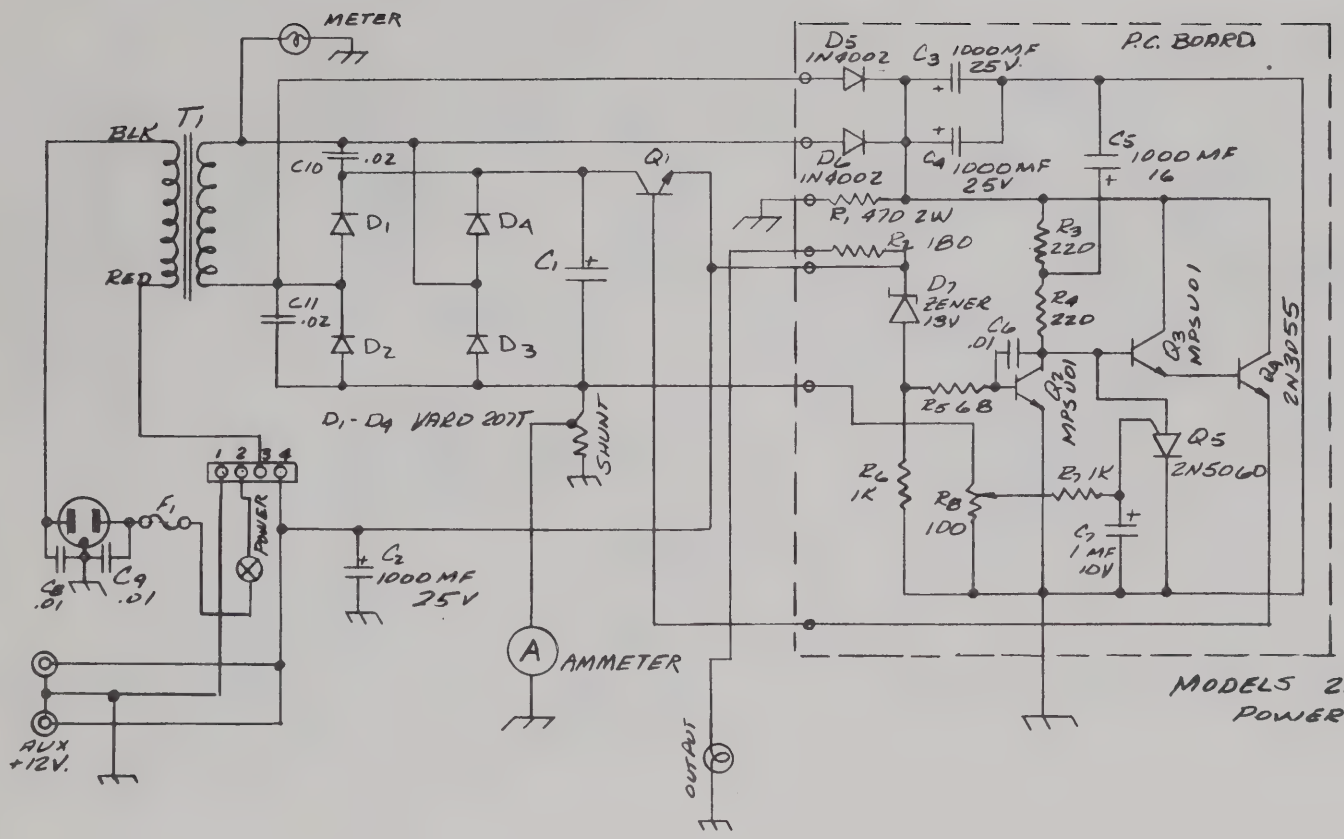
NOTE: - T1 PRI FOR 115/230

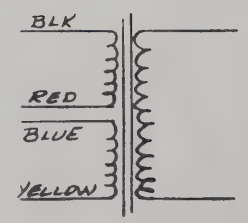
1. 115V: CONNECT BLK TO BLUE & RED TO YELLOW
2. 230 V: CONNECT RED TO BLUE

SYM	MODEL 252M
F1	4 A
Q1	2N6258
SHUNT	.03 15W
C1	17000M
A	0-25 A.

252 M

12-77





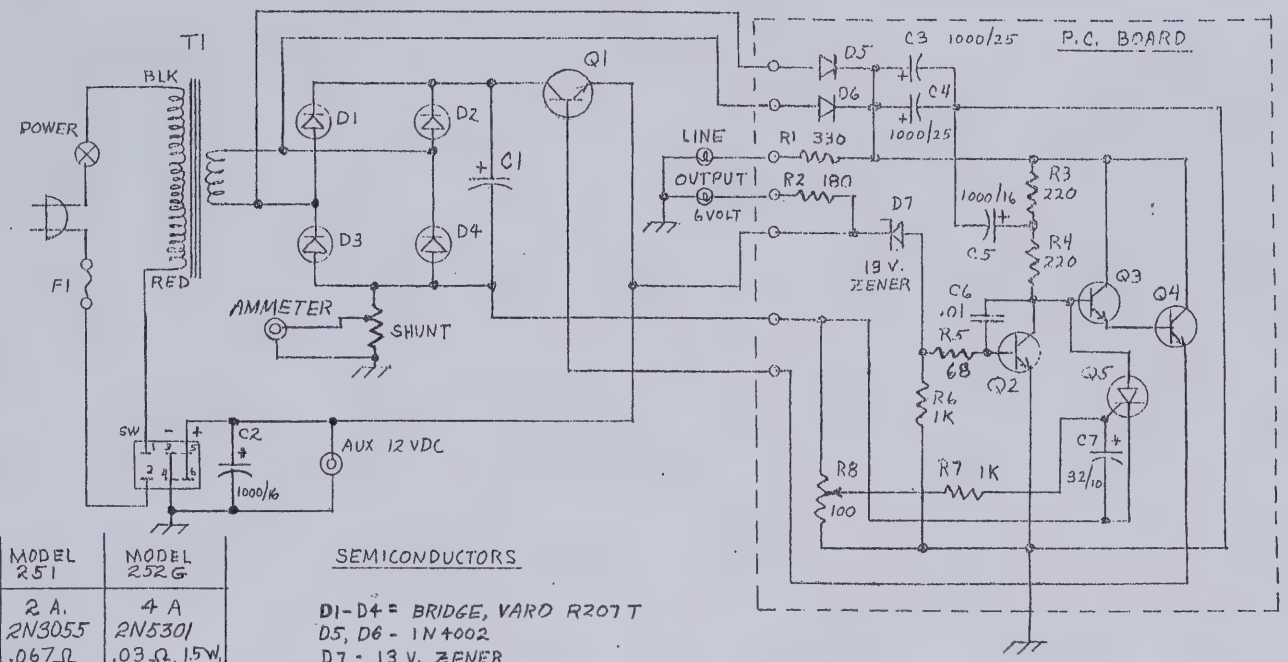
NOTE:- T1 PRI FOR 115/230

1. 115V: CONNECT BLK TO BLUE & RED TO YELLOW
2. 230V: CONNECT RED TO BLUE

SYM	MODEL 251	MODEL 252 G
F1	2A.	4A.
Q1	2N3055	2N6258
SHUNT	.067 8W	.03 15W
C1	13000M	17000M
A	0-12 A.	0-25 A.

MODELS 251M + 252M
POWER SUPPLIES 12-77

NO.	ENG. CHANGE	DATE
	REV.	10-75



SYM.	MODEL 251	MODEL 252G
F1	2 A.	4 A
Q1	2N3055	2N5301
SHUNT	.067Ω 8 W.	.03Ω, 15W.
C1	13,000 M	26,000 M

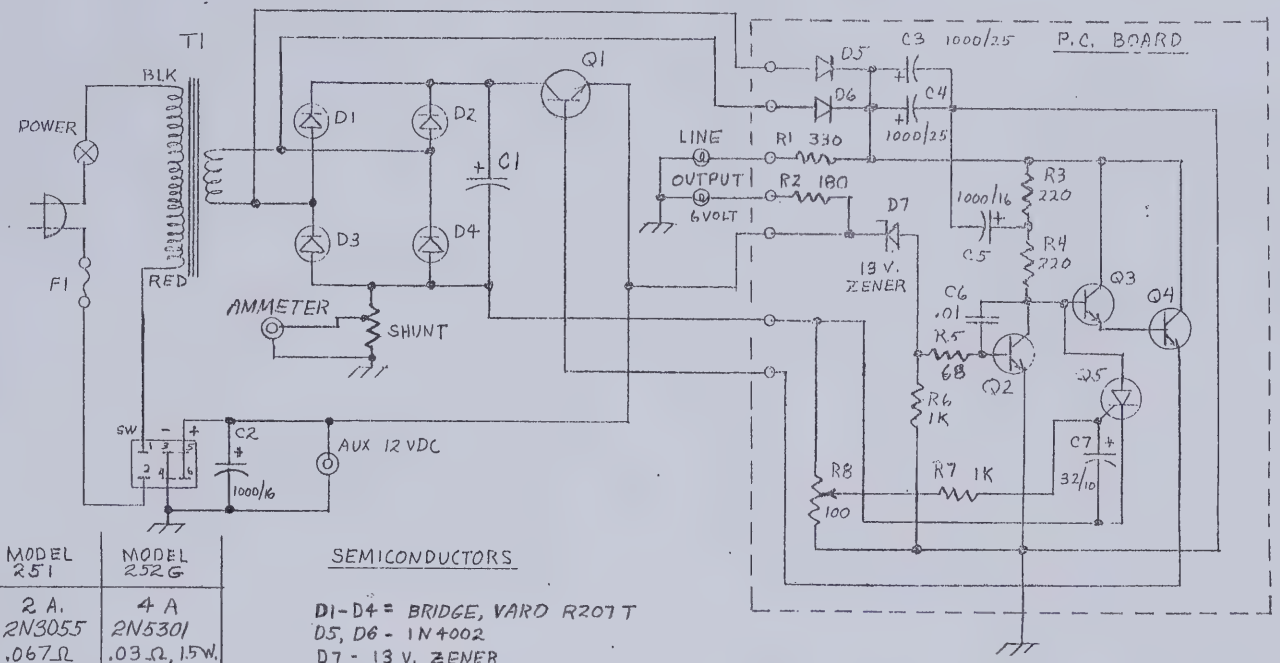
SEMICONDUCTORS

D1-D4 = BRIDGE, VARO R207T
D5, D6 - 1N4002
D7 - 13 V. ZENER
Q2, Q3 - MPS U01
Q4 - 2N3055
Q5 - 2N5060

MODELS 251 AND 252G POWER SUPPLIES

TEN-TEC INC.
SEVIERVILLE, TENN.

NO.	ENG. CHANGE	DATE
		REV. 11-75



SYM.	MODEL 251	MODEL 252G
F1	2 A.	4 A
Q1	2N3055	2N5301
SHUNT	.067Ω 8 W.	.03Ω, 15W.
C1	13,000 M	26,000 M

SEMICONDUCTORS

D1-D4 = BRIDGE, VARO R207T
D5, D6 - 1N4002
D7 - 13 V. ZENER
Q2, Q3 - MPS U01
Q4 - 2N3055
Q5 - 2N5060

MODELS 251 AND 252G POWER SUPPLIES

TEN-TEC INC.
SEVIERVILLE, TENN.

TEN-TEC MODEL 937
POWER SUPPLY

GENERAL

The Model 937 is a general purpose power supply that is intended to be used with the SCOUT, Model 555, transceiver. The rated output is 13.8 VDC @ 7 amps continuous and 11 amps intermittent. Over-voltage protection and current limiting are standard features. The input is 120 VAC, 50-60 Hz.

INSTALLATION

Binding posts are provided on the rear panel for power cable connection. Connect the **RED** (+13.8 VDC) power lead to the **RED (POSITIVE)** binding post and the **BLACK** (ground) power lead to the **BLACK (NEGATIVE)** binding post.

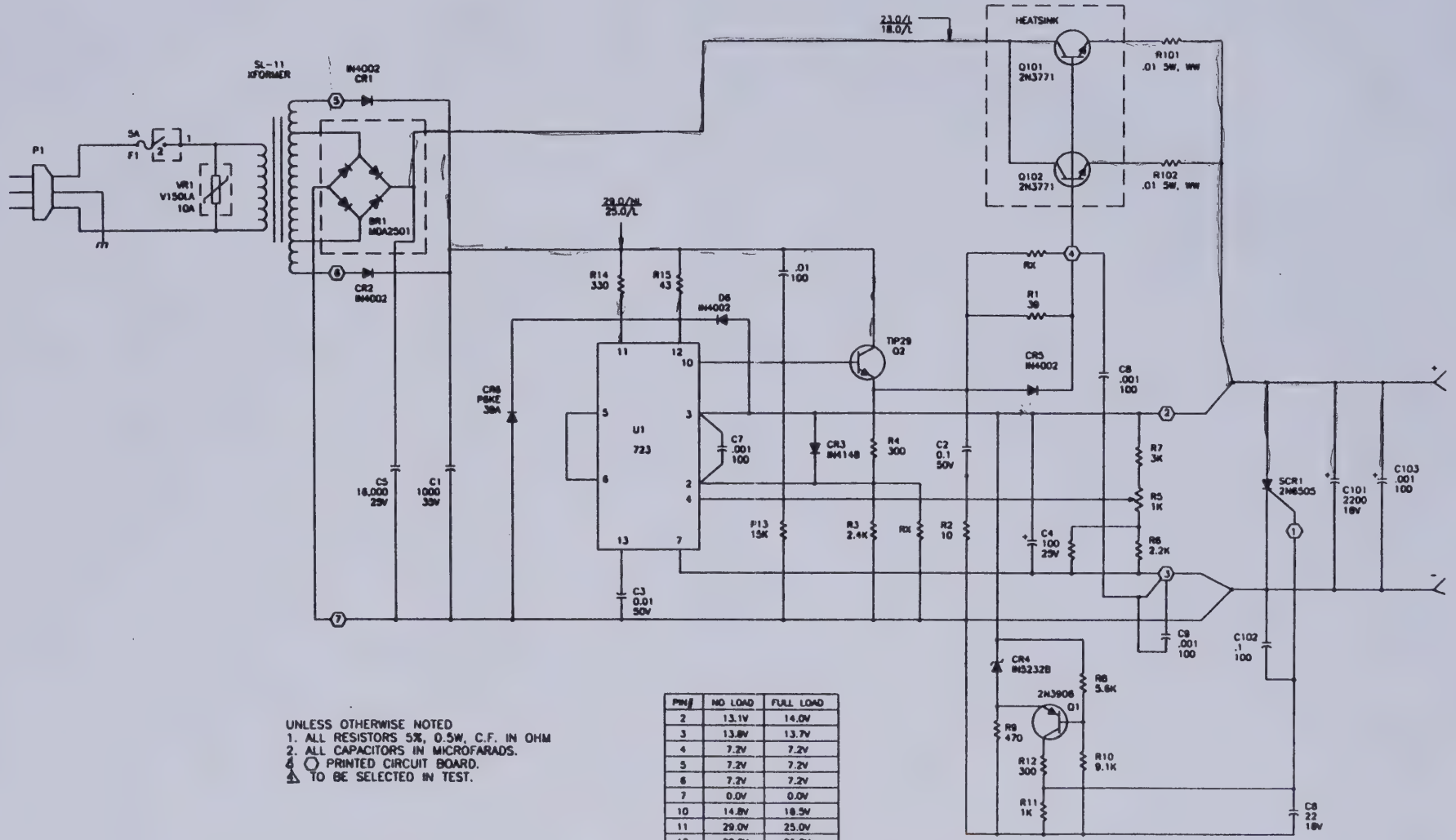
SCHEMATIC - On back of this sheet.

TEN-TEC, INC.
1185 Dolly Parton Parkway
Sevierville, TN 37862
U.S.A.

Switchboard 423-453-7172
Customer Service 423-428-0364
FAX 423-428-4483

June, 1996
Printed in U.S.A.

Part No. 74241



PIN	NO LOAD	FULL LOAD
2	13.1V	14.0V
3	13.8V	13.7V
4	7.2V	7.2V
5	7.2V	7.2V
6	7.2V	7.2V
7	0.0V	0.0V
10	14.8V	18.5V
11	29.0V	25.0V
12	29.0V	25.0V
13	16.1V	17.8V

UNLESS OTHERWISE NOTED
1. ALL RESISTORS 5%, 0.5W, C.F. IN OHM
2. ALL CAPACITORS IN MICROFARADS.
3. ⬡ PRINTED CIRCUIT BOARD.
4. ⚠ TO BE SELECTED IN TEST.

5 CIRCUIT

TEN-TEC	MODEL 937	7-8-93

TEN-TEC MODEL 962
POWER SUPPLY/SPEAKER

GENERAL

The Model 962 Power Supply is designed to power the TEN-TEC models 560/561/563 and 585 transceivers. The supply delivers 20 Amps at 13.5 Vdc from a 115/230 Vac 50-60 Hz source. Circuit features include an electronic over-current sensor which shuts off the output if the current demand exceeds 22 Amps. The over-current shut down condition is reset by cycling the POWER switch from ON to OFF and back to ON.

The output voltage is available through a 4 x 14 gauge 3 foot cable and connector. The cable carries +13.5 Vdc, ground and the "hot" side of the AC primary and mates directly to the POWER jack on the 560/561/563 and 585 transceivers. Two RCA phono jacks on the back of the supply also provide +13.5 Vdc for low current (2 or 3 amps) auxiliary applications.

INSTALLATION

Any high current connections should be made at the 4 pin connector at the end of the output cable. Pin 1 (black wire) is the chassis ground and high current return. It is identified by a rib on the plastic shell of the connector. Pins 2 and 3 (white wires) are connected in series with the front panel POWER switch and carry the "hot" side of the 115/230 Vac line. These two lines facilitate remote ON/OFF switching of the power supply. Pin 4 (red wire) is the +13.5 Vdc output.

If the supply is to be used with equipment other than TEN-TEC transceivers, pins 2 and 3 must be connected together to turn on the supply. These two pins are at 115/230 Vac and carry up to 3 Amps under full load. If the cable length must be extended for some application, a heavy gauge wire, at least #14, must be used. Significant voltage drops can occur even in heavy cable with a 20 Amp load. When using the supply with the 560/561/563 or 585, provide a good interchassis connection by running a separate heavy braid or wire between the ground posts on the rear panels. In RF communication systems, a connection from chassis to earth ground is simply good practice.

The phone jacks marked AUX + 13.5 V are connected in parallel with the high current output cable. Each may be used to power auxiliary equipment that does not draw more than 3 Amps. The center terminal is positive, the shell is ground.

If you wish to use the built-in speaker, insert the 1/4" phone plug, cabled through the back of the supply, into the EXT SPKR jack of the transceiver.

PART NO. 74252

JUNE 1996
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230 VAC OPERATION

Before operating the supply from 230 Vac, the line voltage selector switch on the left side of the supply must be moved with a screwdriver blade to display "230". Replace the back panel line fuse with the MDL 2.5 type fuse included in the packing kit.

If the AC line plug is to be replaced for 230 Vac operation, preserve the original line, neutral and ground connections. In the line cord itself, the center green conductor is chassis ground and should be wired to pick up ground in the house wiring. The neutral side of the AC is carried on the side of the line cord which has small grooves along the length of the outer insulation. The "hot" AC line is carried in the conductor covered by the smooth insulation.

CAUTION

NEVER operate the power supply from 230 Vac when the line voltage selector switch is in the 115 position or vice versa.

OPERATING HINTS

1) Connect the line cord to a proper source of voltage. This is a three wire plug and is intended to pick up the ground of the AC house wiring. Do not defeat the ground connection by using an adapter plug.

2) Connect the load to the 4 pin connector as described above.

3) Turn on the unit and check that the front panel indicator lights are on. This LED is powered directly from the regulated output.

4) To reset the over-current trip-out, turn off the unit with the front panel POWER switch, then turn it back on. If the over-current condition remains, the supply will again shut down. Remove the source of the overload and reset the supply as before.

5) FUSES: If the line fuse or internal 25 Amp fuse must be replaced, use the identical type FUSE.

   115 Vac Line Fuse - MDL 5
   230 Vac Line Fuse - MDL 2.5

6) HIGH CURRENT OPERATION: Do not place the power supply in a closed area or small space where air cannot circulate freely around the heat sink on the rear panel. This heat sink should have free access to normal air convection currents. Never set anything, books, magazines and so forth, on top of the heat sink or where they can cover the ventilation slots in the side of the supply.

JUNE 1996
PRINTED IN U.S.A.
PART NO. 74252

With 20 Amp loads, some voltage drop at the load is unavoidable. The three foot cable and connector to connector interface can account for up to 0.30 Vdc of loss. If excessive voltage drop at the load is indicated, the connector should be inspected for dirty contacts and wear. After years of use, the contacts in the connector tend to spread and tarnish and may require cleaning or replacement.

SPECIFICATIONS

Input Voltage: 105-125 Vac or 210-250 Vac, 50-60 Hz.

Output Voltage: 13.8 Vdc, internally adjustable from 11.5 to 15.0 Vdc.

Output Current: 20 Amps full load, 22 Amps maximum for 5 minutes.

Current Limiting: Electronically disables output. Factory set threshold at 22 Amps.

Regulation: - 3% at output connector for no load to 20 Amps full load.

Ripple: 20 mV peak to peak at 20 Amps.

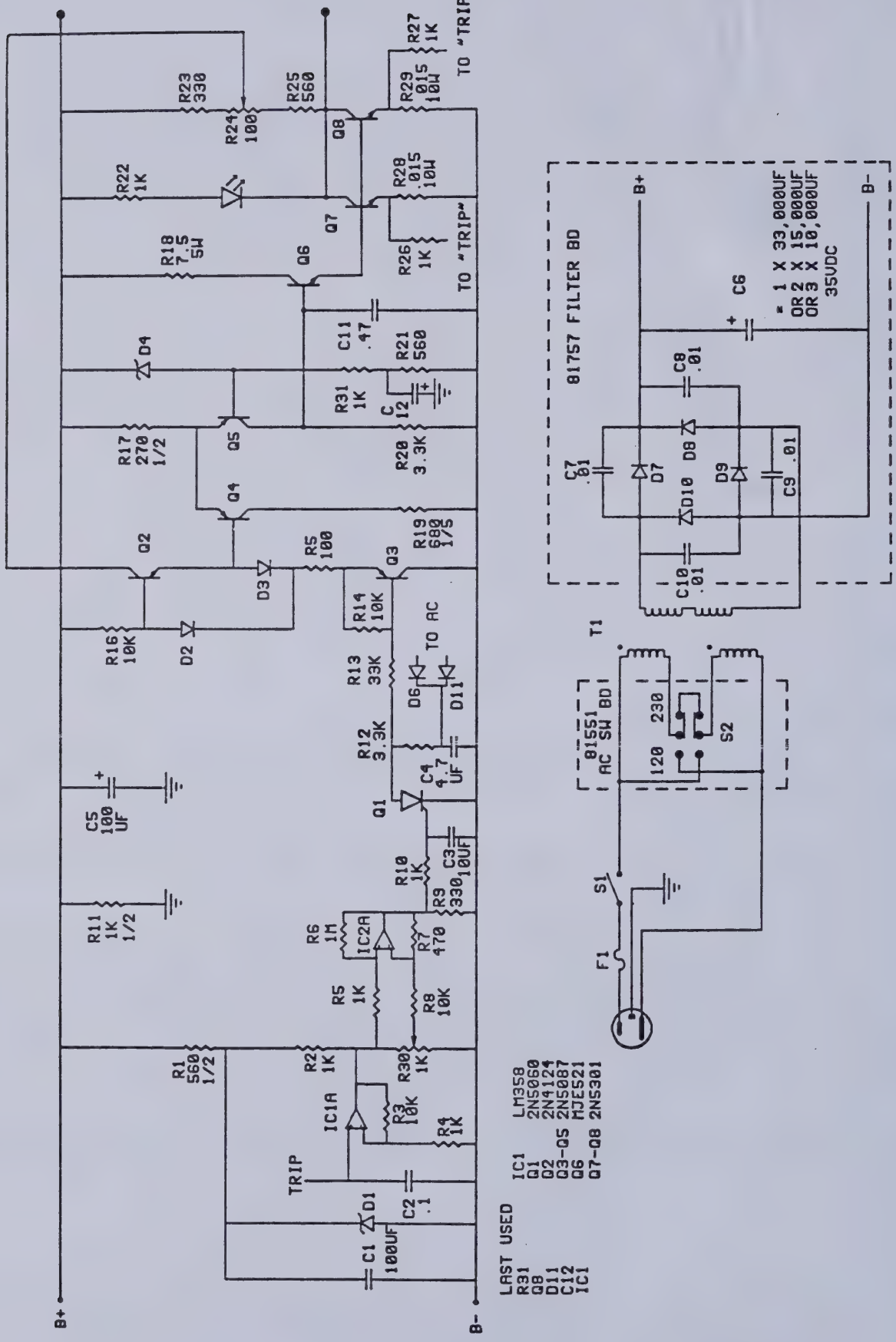
Speaker Impedance: 8 ohms.

CIRCUIT DESCRIPTION

The Model 962 uses a linear series regulator type circuit based on the '723 regulator chip and two 2N5301 pass transistors.

The "hot" side of the AC mains is fused by the rear panel line fuse, then sent down the heavy 4 conductor cable where a jumper or switch at the load end of the cable connects pins 2 and 3. Pin 3 leads back to the POWER switch and on the dual primaries of transformer T1. The voltage selector switch on the left side of the 962 configures the transformer primary windings for either 115 or 230 Vac.

The secondary of T1 feeds the high current bridge rectifier D4 which develops unregulated dc for the pass transistors. Separate rectifiers D2 and D3 provide dc power for the regulator circuit.



SCHEMATIC DIAGRAM OF MODEL 962 POWER SUPPLY/SPEAKER

JUNE 1996
PRINTED IN U.S.A.

PART NO. 74252

TEN-TEC MODEL 960 POWER SUPPLY/SPEAKER

GENERAL

The Model 960 Power Supply is designed to power the TEN-TEC models 560/561 and 585 transceivers. The supply delivers 20 Amps at 13.5 Vdc from a 115/230 Vac 50-60 Hz source. Circuit features include an electronic over-current sensor which shuts off the output if the current demand exceeds 22 Amps. The over-current shut down condition is reset by cycling the POWER switch from ON to OFF and back to ON. Output over-voltage protection is also included to prevent the output voltage from exceeding 16.0 Vdc.

The output voltage is available through a heavy duty 3 foot cable and connector. The cable carries +13.5 Vdc, ground and the "hot" side of the ac primary and mates directly to the POWER jack on the 560/561 and 585 transceivers. Two RCA phono jacks on the back of the supply also provide +13.5 Vdc for low current (2 or 3 amps) auxiliary applications.

INSTALLATION

Any high current loads should be drawn from the 4 pin connector at the end of the output cable. Pin 1 (black wire) is the chassis ground and high current return. It is identified by a rib on the plastic shell of the connector. Pins 2 and 3 (white wires) are connected in series with the front panel POWER switch and carry the "hot" side of the the 115/230 Vac line. These two lines facilitate remote ON/OFF switching of the power supply. Pin 4 (red wire) is the +13.5 Vdc output.

If the supply is to be used with equipment other than TEN-TEC transceivers, pins 2 and 3 must be connected together to turn on the supply. These two pins are at 115/230 Vac and carry up to 3 Amps under full load. If the cable length must be extended for some application, a heavy gauge wire, at least #14, must be used. Significant voltage drops can occur even in heavy cable with a 20 Amp load. Maximum length should be 4 feet. When using the supply with the 560/561 or 585, provide a good interchassis connection by running a separate heavy braid or wire between the ground posts on the rear panels. In rf communication systems, a connection from chassis to earth ground is simply good practice.

The phone jacks marked AUX +13.5 V are connected in parallel with the high current output cable. Each may be used to power auxiliary equipment that does not draw more than 3 Amps. The center terminal is positive, the shell is ground.

If you wish to use the built-in speaker, insert the 1/4" phone plug, cabled through the back of the supply, into the EXT SPKR jack of the transceiver.

230 Vac OPERATION

Before operating the supply from 230 Vac, the line voltage selector switch on the bottom of the supply must be moved with a screwdriver blade to display "230". Next replace the back panel line fuse with the MDL 2 type fuse contained in the packing kit.

If the ac line plug is to be replaced for 230 Vac operation, please preserve the original line, neutral and ground connections. In the line cord itself, the center green conductor is chassis ground and should be wired to pick up ground in the house wiring. The neutral side of the ac is carried on the side of the line cord which has small grooves along the length of the outer insulation. The "hot" ac line is carried in the conductor covered by the smooth insulation.

CAUTION

NEVER operate the power supply from 230 Vac when the line voltage selector switch is in the 115 position or visa versa.

OPERATING HINTS

1) Connect the line cord to a proper source of voltage. This is a three wire plug and is intended to pick up the ground of the ac house wiring. Do not defeat the ground connection by using an adapter plug.

2) Connect the load to the 4 pin connector as described above.

3) Turn on the unit and check that the front panel indicator lights. This LED is powered directly from the regulated output and will always indicate the over-current shut down condition by going out.

4) To reset the over-current trip out, turn off the unit with the front panel POWER switch, then turn it back on. If the over-current condition remains, the supply will again shut down and the LED indicator will stay out. Remove the source of the overload and reset the supply as before.

5) If the over-voltage protection circuit detects an output over-voltage condition, it will short the output to ground. If the condition was caused by noise on the ac line (near-by lighting strike, etc.) the over-voltage circuit will trigger the over-current shut down and the supply must be reset as before. If, however, the over-voltage condition is the result of a component failure in the supply, the over-voltage circuit will blow the 25 Amp fuse mounted internally on the pass transistor board. If this fuse is blown, it indicates that possibly some internal part has failed and service may be required.

6) FUSES: If the line fuse or internal 25A fuse must be replaced use the identical type fuse.

   Internal 25 A Fuse - AGC 25
   115 Vac line fuse - MDL 4
   230 Vac line fuse - MDL 2

7) HIGH CURRENT OPERATION: Do not place the power supply in a closed area or small space where air cannot circulate freely around the heat sink on the rear panel. This heat sink should have free access to normal air convection currents. Never set anything, books, magazines and so forth, on top of the heat sink or where they can cover the ventilation slots in the side of the supply.

With 20 Amp loads, some voltage drop at the load is unavoidable. The three foot cable and connector to connector interface can account for up to 0.30 Vdc of loss. If pilot lamps in the driver equipment appear to dim or if excessive voltage drop at the load is indicated, the connector should be inspected for dirty contacts and wear. After years of use, the contacts in the connector tend to spread and tarnish and may require cleaning or replacement.

SPECIFICATIONS

Input Voltage: 109-125 Vac or 218-250 Vac, 50-60 Hz.

Output Voltage: 13.8 Vdc, internally adjustable from 11.5 to 15.0 Vdc.

Output Current: 20 Amps full load, 22 Amps maximum for 5 minutes.

Current Limiting: Electronically disables output. Factory set threshold at 22A.

Regulation: - 3% at output connector for no load to 20 A full load.

Ripple: 20 mV peak to peak at 20A.

Speaker Impedance: 8 ohms.

CIRCUIT DESCRIPTION

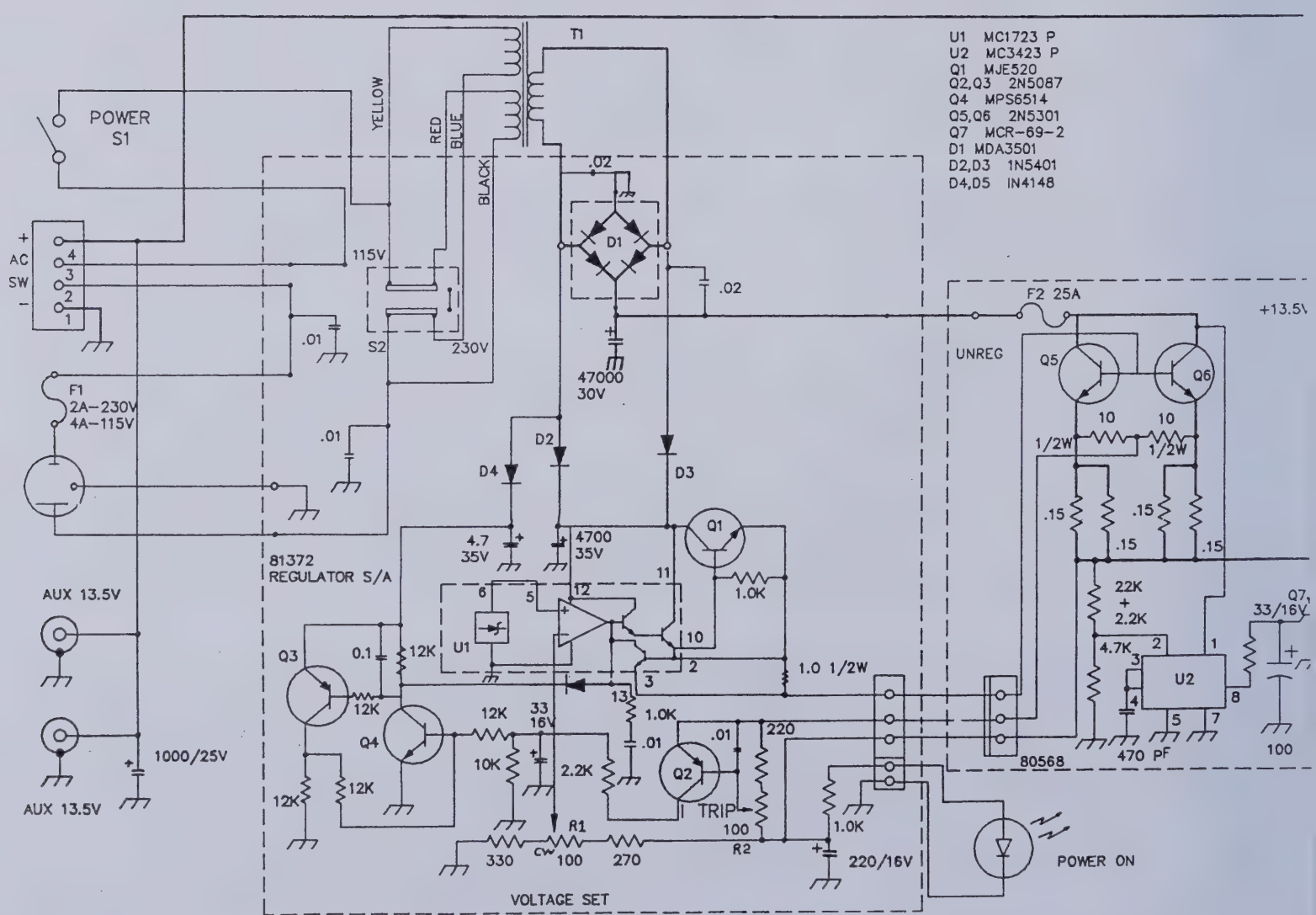
The Model 960 uses a linear series regulator type circuit based on the '723 regulator chip and two 2N5301 pass transistors.

The "hot" side of the ac is fused by the rear panel line fuse F1 then sent down the heavy 4 conductor cable where a jumper or switch at the load end of the cable connects pins 2 and 3. Pin 3 leads back to the POWER switch S1 on the 960 and on to the dual primaries of transformer T1. The voltage selector switch S2 on the bottom of the 960 configures the transformer primary windings for either 115 or 230 Vac.

The secondary of T1 feeds high current bridge rectifier D1 which develops unregulated dc for the pass transistors. Seperate rectifiers D2 and D3 provide dc power for the regulator circuit. Regulator chip U1 compares a sample of the output voltage from R1, the output voltage trimmer, to an on-chip reference voltage. Any difference between the output and reference voltages is amplified and used to correct the bias on transistor Q1. Q1 then drives the bases of pass transistors Q5 and Q6.

The over-current shut-down circuit consists of transistors Q3 and Q4 which form an SCR type latch. Q2 acts as the trigger. Output current is sampled across the 0.15 ohm ballast resistors at the emitters of Q5 and Q6. This voltage drop appears across resistor R2, the over-current set trimmer, and biases Q2. Excessive current drain will develop sufficient voltage across the ballast resistors to turn on Q2 and fire the over-current SCR circuit Q3 and Q4. With Q4 turned on, and latched by Q3, the drive from regulator U1 is shunted to ground through D5. The latching action of Q3 keeps the supply disabled until the over-current circuit is reset by cycling the POWER switch.

Over-voltage protection is provided by U2 and SCR "crowbar" Q7. If the output voltage exceeds the factory set threshold of 15.9 Vdc, U2 will trigger Q7 into conduction and either trip the over-current circuit or blow the internal 25 Amp fuse F2.



TEN-TEC MODELS 251 + 252G POWER SUPPLIES

GENERAL

The TEN-TEC Model 251 Power Supply will deliver up to 9 amperes at approximately 13 VDC, regulated, from a 117 VAC 50-60 Hz source. An electronic latching circuit breaker shuts down the output voltage when a current in excess of 10 amperes is drawn from the supply. Reset is accomplished by cycling the POWER switch. Two indicator lamps monitor the LINE and OUTPUT voltages. The primary circuit is fused with a slo-blo fuse. The output voltage is available through a six pin Jones connector and a phono type jack for low current applications. Two of the six Jones pins are used for remote power on-off switching, if desired.

The Model 252G is similar to the Model 251 except that it will deliver up to 18 amperes at approximately 13 VDC. The circuit breaker in this model is factory set to trip at 20 amperes, and the line fuse rating is twice that of the Model 251. Either model will accept Model 207 Ammeter.

The circuit consists of a bridge rectifier, followed by a high capacitance filter. This, in turn, is followed by a series type transistor regulator whose base voltage is derived from a three transistor regulator. The "crow-bar" type circuit breaker consists of a SCR which removes the base voltage from one of the regulator transistors when fired. The SCR signal is developed across a low value sampling resistance in series with the load.

INSTALLATION

1.) Output Cables and Connectors - The high current output should be drawn from the six pin Jones connector. Pins 3 and 4, the two vertical center pins are negative GND, and are marked on the chassis with a -sign. Pins 5 and 6, the two vertical pins nearest the end panel and marked +, are the positive terminals. Pins 1 and 2 are connected in series with the POWER switch and are used with a remote on-off switch, if desired. If the supply is to be turned on and off only by the front panel switch, pins 1 and 2 should be jumpered together in the plug. The unit will be inoperative without this jumper, or if the plug is removed from the socket. Keep interconnecting cables carrying the high current as short as possible, and of a wire gauge greater than, or equal to #14. Sizable cable voltage drop will be experienced with long cables and/or small wire sizes. Always jumper the two pins available for the minus together and the two for the plus, to reduce pin resistance to a minimum.

Provide a good interchassis connection by running a separate heavy braid or stranded wire between them, using the ground lug terminal provided near the output connectors. In rf communication systems, a connection from chassis to a good earth ground is also recommended.

The phono jack marked AUX. 12V is connected in paralled with the output from the Jones socket and may be used to power auxiliary equipment that does not draw more than 1 ampere. Center terminal is positive, shell is negative.

2.) Models 251/E and 252G/E - These models have a dual primary winding on the power transformer, permitting operation from either 115 or 230 VAC. They are factory wired for 230 volt operation and do not have plugs on the line cords. To change from 230 to 115 volt primary, see instructions printed on the inside cover of the supply.

3.) Model 207 Ammeter - The upper phono jack marked AMMETER accepts the cable attached to the Model 207 Ammeter. This meter utilizes the internal shunt resistance of the supply and because of this, requires no alteration when used with either the 9 or 18 ampere supply. Just read the appropiate scale.

OPERATION

1.) Connect line cord to proper source of voltage, and load to output connectors as described above.

2.) Turn unit on by pressing the push POWER switch. The two lamps should indi-

cate that both LINE and OUTPUT voltages are present. If OUTPUT lamp does not light, check load and cables for short or excessive current situation.

3.) If the load current is variable, some dimming of the LINE lamp may be observed. The OUTPUT lamp, however, monitors the regulated voltage and should not dim with current drains up to rated values. If pilot lamps in the driven equipment dim with increased load current, but OUTPUT lamp does not, it is an indication that a loss of voltage to the load is present in the cables. To remedy, use shorter cables and larger wire size.

4.) To reset the circuit breaker after it shuts down the OUTPUT voltage, as monitored by its pilot lamp, turn unit off and wait approximately three seconds. Then switch unit on again. If the short or overload remains, the breaker will again shut the unit down. Remove cause of overload and reset as before. It is necessary to wait several seconds to allow the circuit capacitors to discharge sufficiently for proper resetting.

5.) Fuses - In the event that the line fuse blows, replace with an identical type Slo-Blo.

Model 251 - 115 VAC operation: 2A.
Model 251/E - 230 VAC operation: 1A.
Model 252G - 115 VAC operation: 4A.
Model 252G/E - 230 VAC operation: 2A.

6.) Do not place power supply in a small volume where normal room air cannot reach the heat sink mounted on the rear panel. This heat sink should have free access to normal convection air currents. When operating the supplies near rated full load for relatively long periods of time, the heat sink will become very warm, and in the case of the Model 252G can approach temperatures of approximately 200° F. If extended operation is anticipated and/or the line voltage is above the mean values or 115 or 230, it is recommended that a small fan be used to circulate air around the heat sink fins. For normal CW or SSB Amateur communications applications, where the duty cycle is no greater than 60%, no extracrdinary precautions need be taken in this regard.

Specifications Common to Models 251 & 252G

Input Voltage: 117 VAC, 50-60 Hz.
Output Voltage: 13 VDC, ± 0.5V. Regulated.
Regulation: Better than 1%, no load to full load @ 117 VAC.
Construction: Aluminum with molded plastic side panels.
Output Connectors: One 6 pin Jones type.
One Phono jack for low current.
One Phono jack for Model 207 Ammeter.

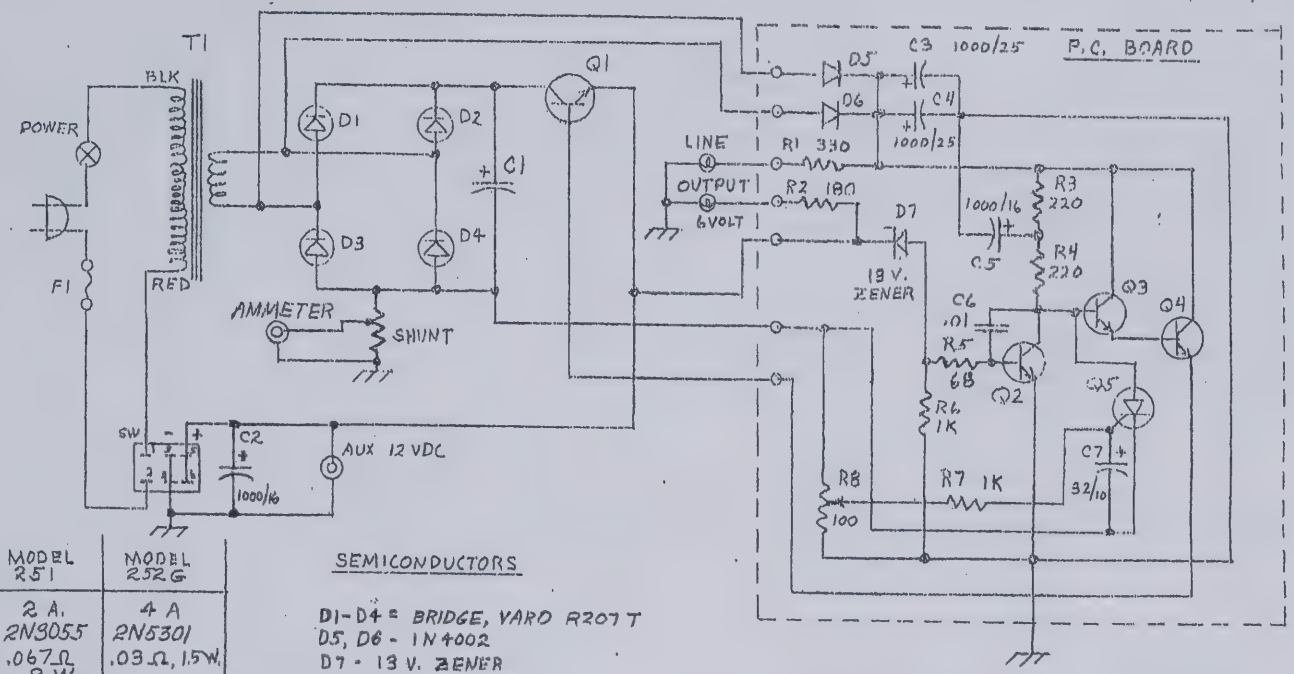
Specifications for Model 251

Output Current: 9 amperes continuous, full load.
10 amperes, maximum.
Circuit Breaker: Electronic latching. Factory set to trip at 10 A.
Ripple: Less than 25 mV, peak-to-peak @ 9 A and 117 VAC.
Size: HWD 4½" x 8¼" x 8".
Weight: 9½ lbs.

Specifications for Model 252G

Output Current: 18 amperes continuous, full load.
20 amperes, maximum.
Circuit Breaker: Electronic latching. Factory set to trip at 20 A.
Ripple: Less than 60 mV, peak-to-peak @ 18 A and 117 VAC.
Size: HWD 4½" x 8¼" x 13".
Weight: 14½ lbs.

NO.	ENG. CHANGE	DATE
		REV. 10-75



SYM.	MODEL 251	MODEL 252G
F1	2 A.	4 A
Q1	2N3055	2N5301
SHUNT	.067 Ω 8 W.	.03 Ω, 15 W.
C1	13,000 M	26,000 M

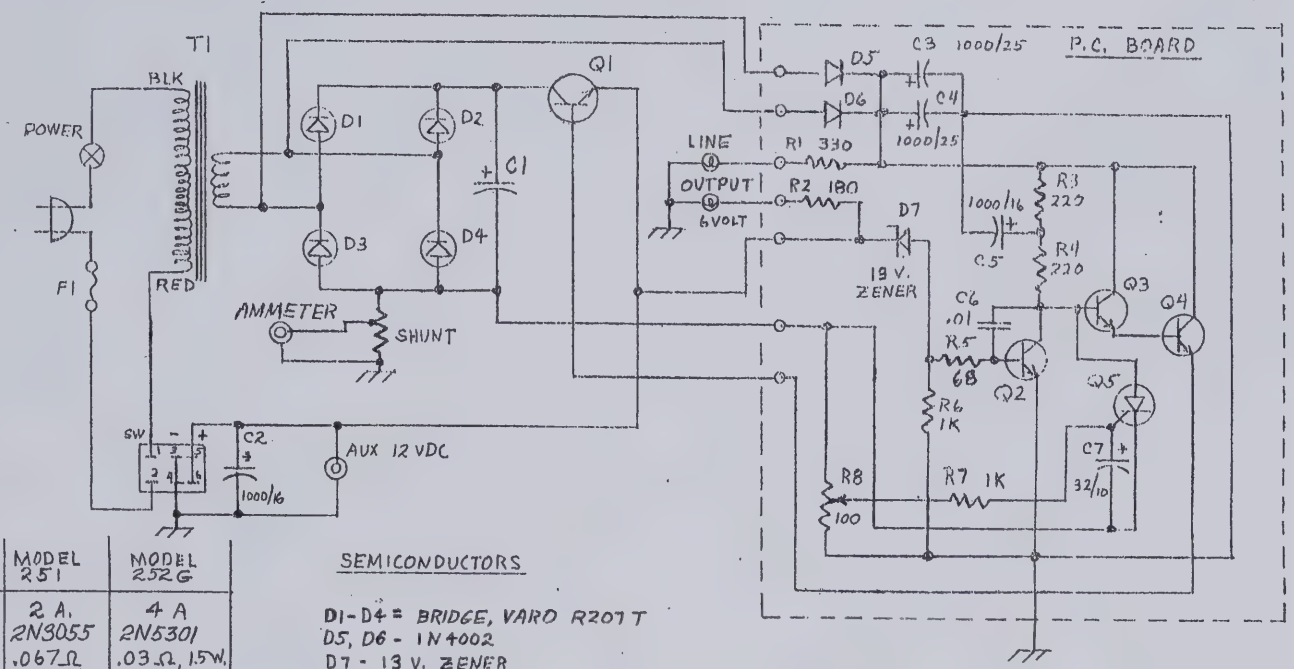
SEMICONDUCTORS

D1-D4 = BRIDGE, VARO R207T
D5, D6 - 1N4002
D7 - 13 V. ZENER
Q2, Q3 - MPS U01
Q4 - 2N3055
Q5 - 2N5060

MODELS 251 AND 252G POWER SUPPLIES

TEN-TEC INC.
SEVIERVILLE, TENN.

NO.	ENG. CHANGE	DATE
	REV.	11-75



SYM.	MODEL 251	MODEL 252G
F1	2 A.	4 A
Q1	2N3055	2N5301
SHUNT	.067Ω 8 W.	.03Ω, 15W.
C1	13,000 M	26,000 M

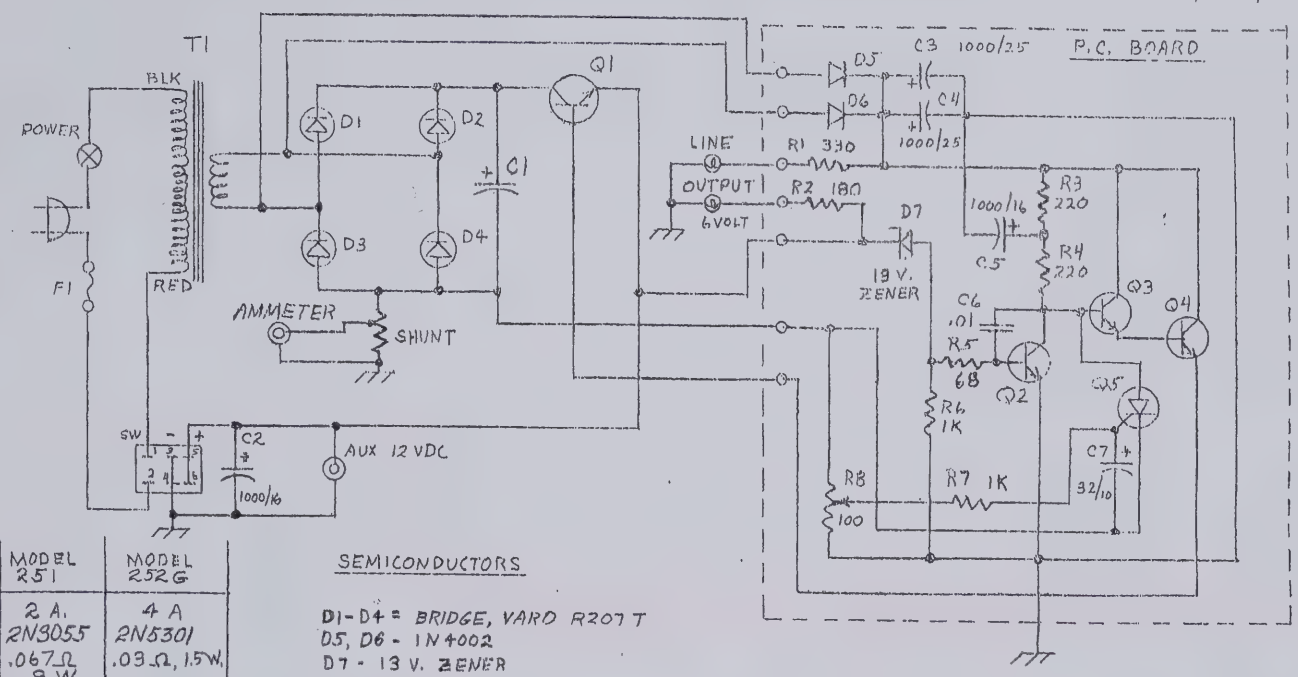
SEMICONDUCTORS

D1-D4 = BRIDGE, VARO R207T
D5, D6 - 1N4002
D7 - 13 V. ZENER
Q2, Q3 - MPS U01
Q4 - 2N3055
Q5 - 2N5060

MODELS 251 AND 252G POWER SUPPLIES

TEN-TEC INC.
SEVIERVILLE, TENN.

NO.	ENG. CHANGE	DATE
		REV. 10-75



SYM.	MODEL 251	MODEL 252G
F1	2 A.	4 A
Q1	2N3055	2N5301
SHUNT	.067Ω 8 W.	.03Ω, 15W.
C1	13,000 M	26,000 M

SEMICONDUCTORS

D1-D4 = BRIDGE, VARO R207T
D5, D6 - 1N4002
D7 - 13 V. ZENER
Q2, Q3 - MPS U01
Q4 - 2N3055
Q5 - 2N5060

MODELS 251 AND 252G POWER SUPPLIES

TEN-TEC INC.
SEVIERVILLE, TENN.

TEN-TEC

OWNER'S MANUAL

Model 260

TEN-TEC MODEL 260 POWER SUPPLY

GENERAL

The Model 260 Power Supply is designed to deliver 20A at 13.5V from a 115/230 V ac 50-60 Hz source. An electronic latching circuit breaker shuts off the output voltage when the current drawn from the supply exceeds 20 amperes. When this breaker trips, the power indicator LED goes out indicating loss of output. The breaker is reset by cycling the POWER switch from ON to OFF and back to ON. The primary circuit is fused with a 4 ampere fuse on 115 V ac. The output voltage is available through a four pin AMP connector at the end of a three foot power cord and at two phono type jacks for low current applications. The center two of the four AMP pins are used for remote power on-off switching. A 4w maximum ceramic magnet speaker is mounted on the front panel.

The circuit consists of a bridge rectifier followed by a high capacitance filter. This in turn, is followed by two parallel transistors in a series regulator circuit whose base voltage is derived from an integrated circuit regulator and driver transistor. The circuit breaker consists of a SCR latching circuit which turns off the regulator when the current drawn exceeds the set limit. The SCR triggering signal is developed across a pair of low value resistors in series with the output, which also serve to assure sharing of the load current between the two pass transistors. Overvoltage protection of the output is provided by a SCR "Crow-Bar" circuit which short circuits the output if it should rise above 16 V dc.

INSTALLATION

Output Cable and Connectors: The high current output should be drawn from the four pin AMP connector at the end of the output cable. Pin 1 is GND (black) negative, and identified by the rib on the plastic shell of the output connector. Pins 2 and 3 (white) are connected in series with the front panel POWER switch and are used with a remote on-off switch, if desired. Pin 4 is +13.5 volts (red).

If the supply is to be turned on and off only by the front panel switch, pins 2 and 3 should be jumpered together at the connector or where the two white wires attach to the terminal strip inside the unit. Keep interconnecting cables carrying high current as short as possible and of a wire gauge greater than or equal to #14. Sizable cable voltage drop will be experienced if too long or if a small wire size is used.

Provide a good interchassis connection by running a separate heavy braid or stranded wire between them, using the ground lugs provided on the rear panels. In rf communication systems, a connection from chassis to a good earth ground is also recommended.

The phono jacks marked AUX 12V are connected in parallel with the output from the AMP socket and may be used to power auxiliary equipment that does not draw more than five amperes. Center terminal is positive, shell is negative.

Speaker Cable: If you wish to use the built in speaker, insert the phone plug on the cable into the transceiver's ext. speaker jack.

When operating from 230 V ac, turn the 260 over and move the slide switch with a screwdriver blade so that "230" shows through the hole. Then replace the line fuse with the 2A slo-blo type contained in the packing kit.

OPERATION

1.) Connect the line cord to proper source of voltage. This is a three wire cable and the green center conductor should be connected to the main ground system. It is internally connected to the supply chassis.

2.) Connect load to AMP connector as described above.

3.) Turn unit on by pressing the top protruding edge of the POWER switch. The LED should indicate that output voltage is present. If it does not light, check load and cables for short circuit or excessive current situation.

4.) The LED is powered from the regulated output of the supply and should not dim with the current loads up to the rated output. If pilot lamps in the driven equipment dim with increased load current,but the LED stays constant, it is an indication that a loss of voltage is occuring in the interconnecting cables or connectors. To remedy use shorter cable and/or larger wire size.

5.) To reset the circuit breaker after it has shut down the output voltage, turn the unit off and back on again. If the short or overload remains, the breaker will again shut down. Remove the cause of overload and reset again as before.

6.) If for some reason the crow-bar circuit should detect an over-voltage condition it will short the output voltage. If this was caused by a transient spike, the circuit breaker will trip out and must be reset as above. If the overvoltage condition is the result of a component failure, or the overcurrent breaker is inoperative, the internal 20 ampere fuse will open and reset will not be possible. If the internal fuse blows (mounted in fuse clips located on the heatsink circuit board), it indicates that possibly some internal part has failed and service may be required.

7.) Fuses: In the event that the line fuse blows, replace it with an identical type slo-blo. The line fuse holder is located on the rear panel next to the line cord strain bushing.

8.) Do not place the power supply in a closed area or in a small space where normal room air cannot circulate freely around the heat sink on the rear panel. This heat sink should have free access to normal air convection currents. For instance, do not place the supply on the floor in a corner. If this is the only available location, turn it around--fins out. Always operate the supply with the heat sink and fins vertical. Never put anything on top of the heat sink fins.

When operating near full load for relatively long periods of time, the heat sink will become quite hot. The bottom pan of the chassis will also become hot due to power dissipation in the bridge rectifier. The large heat sink is capable of maintaining this type of operation if the free air circulation requirements as above are met. If extended operation is anticipated, and/or the line voltage is above the mean value of 117, it's recommended that a small fan be used to circulate air around the heat sink. For normal CW or SSB Amateur applications, where the duty cycle is less than 60%, a fan should not be necessary. If there is any question as to whether there is enough air circulation around the heat sink, check the temperature of the heat sink. It should not be allowed to go above 100°C or 212°F. To do this, moisten the tip of your finger and touch lightly near one of the transistors on the heat sink. If it sizzles, its too hot.

SPECIFICATIONS

Input Voltage: 105-125 V ac, 50-60 Hz, or 210-250 V ac, 50-60 Hz.
Output Voltage: 13.5 V dc, adjustable 12.5 to 14.0 V dc.
Regulation: Better than 1% no load to full load @ 117 V dc.
Speaker: Ceramic Magnet, 8 ohm.
Output Current: 18 amperes, full load, 20 amperes, maximum.
Circuit Breaker: Electronic latching. Factory set at 20A.
Ripple: Less than 60 mV peak-to-peak at 18A at 117 V ac.
Construction: 16 ga. alumimum chassis and top.
Output Connectors: One 4 pin AMP MATE-N-LOC, two phono jacks for low current.
Size: HWD 5-1/4" x 7-1/2" x 13-1/2"including heat sink.
Weight: 15 lbs.

CIRCUIT DESCRIPTION

Model 260 Power Supply uses a series regulator type circuit incorporating two 2N5301 s as the pass elements. While either transistor could handle the 20A of output by itself, two are used with a generous heat sink to assure plenty of design margin. The .15 ohm resistors in each emitter assures that the load is equally shared between the two pass transistors. They are also used as the sense element for the over-current breaker.

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The circuitry is divided into three assemblies. The chassis contains the transformer and associated ac wiring, bridge rectifier, and filter capacitor. The regulator board contains all the control and drive circuitry. The pass transistor assembly is mounted on the rear heat sink and contains the pass transistors, shunt resistors and the overvoltage crow-bar and its fuse. For ease of service, these three assemblies are interconnected with cable plugs where current requirements permit.

REGULATOR BOARD

The heart of the Model 260 is a 723 integrated circuit voltage regulator. It contains a stable reference voltage source, feedback amplifier, over-current shutdown, and control circuits. The regulator board by itself is a 1 ampere current limited power supply and is used to drive the pass transistors on the heatsink for the required current output. The current sense voltage from the pass transistor board is returned to the regulator board betweens pins E and O. This signal is used to drive the over-current breaker. Potentiometer R10 sets the current trip point. Output voltage is adjusted by R12.

The regulator board has its own rectifier and filter capacitor. Diode D3 and capacitor C2 supply the hold-in current for SCR Q2 when the over-current circuit trips.

As received from the factory, the potentiometers are carefully adjusted for the following settings:

VOLTAGE	Set for 13.5 V dc.
TRIP	Set for 20A.

These should not require further adjustment unless service has been performed on the unit.

PASS TRANSISTOR BOARD

This board contains the series pass transistors. The two 2N5301 transistors are connected in parallel with the ballast resistors on each emitter. These resistors insure that the two transistors share the load current and also are used as current sensing shunts for the current trip circuit.

The crow-bar circuit occupies one corner of the board. If the output voltage should rise above 16 V dc, zener diode D1 will conduct and apply forward bias to the gate of SCR Q3. When Q3 latches, it shorts the supply output to ground, which will either cause the over-current circuit to trip or will blow F1, the 20A fuse.

IN CASE OF DIFFICULTY:

SYMPTOM	POSSIBLE CAUSE
No output when turned on (LED not LIT)	External AC switch not on. (switch between white wires of output cable) Line fuse blown.
No output but LED blinks at turn on	Output shorted.
Output voltage sags with load (LED dims)	Low line voltage. Blown 20A fuse.
Blown 20A fuse	Shorted pass transistor or accidental ground wire contact to transistor case on heatsink.

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VOLTAGE READINGS---PASS TRANSISTOR BOARD

	C (a)	B (g)	E (cath)	
Q1	24.5	14.2	13.5	
Q2	24.5	14.2	13.5	no load, untripped
Q3	13.5	0	0	
Q1	24.5	0	0	
Q2	24.5	0	0	tripped due to overcurrent breaker
Q3	0	0	0	

VOLTAGE READINGS---REGULATOR BOARD (No load)

U1 Pin	723 Volt	I.C. Pin	Volt
1	NC	14	NC
2	14.2	13	16.0
3	14.2	12	24.5
4	7.1	11	24.5
5	7.1	10	14.8
6	7.1	9	NC
7	0	8	NC

NC=No Connection

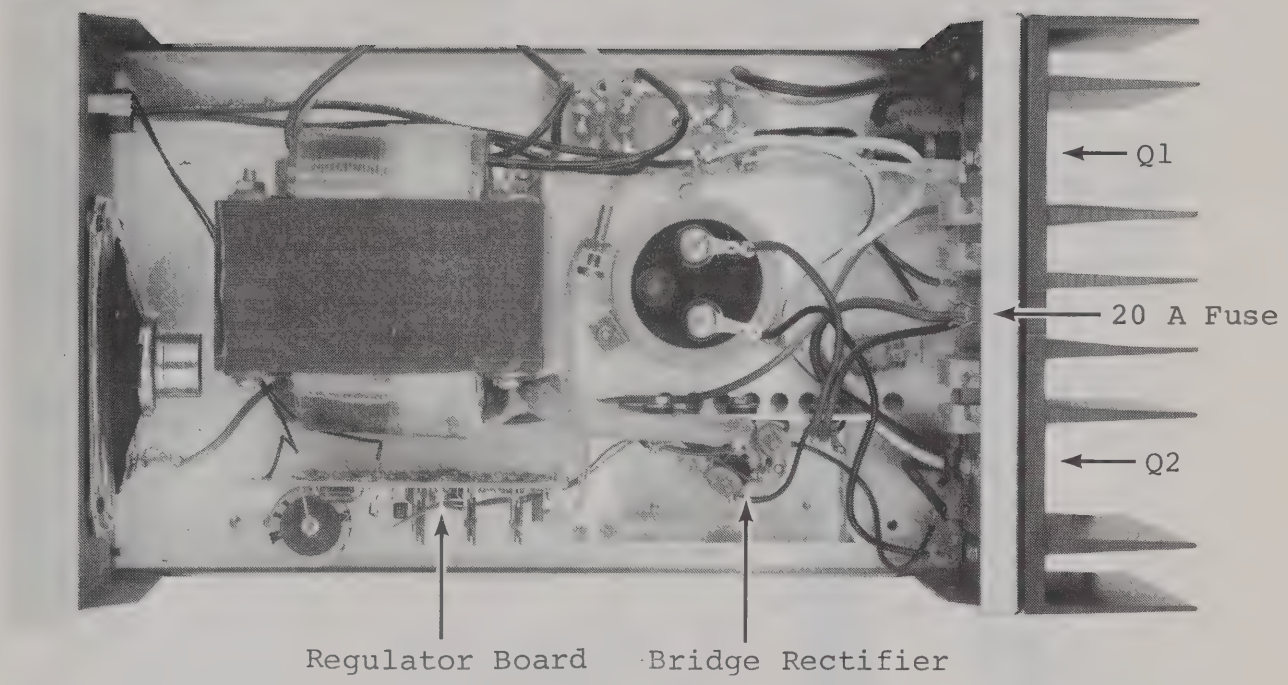
PIN--INNER CONNECTION SOCKETS

B (case)	14.2
E (emitter)	13.5
O (output)	13.5
AC-18 V ac Transistors (scr)	

NO LOAD

	C (A)	B (G)	E (cath)
Q1	24.5	14.8	14.2
Q2	24.5	0	0
Q3	0	13.5	13.5
Tripped by overcurrent			
Q1	24.6	.45	.45
Q2	.7	.75	0
Q3	.5	0	0

1st printing 4-260 10/82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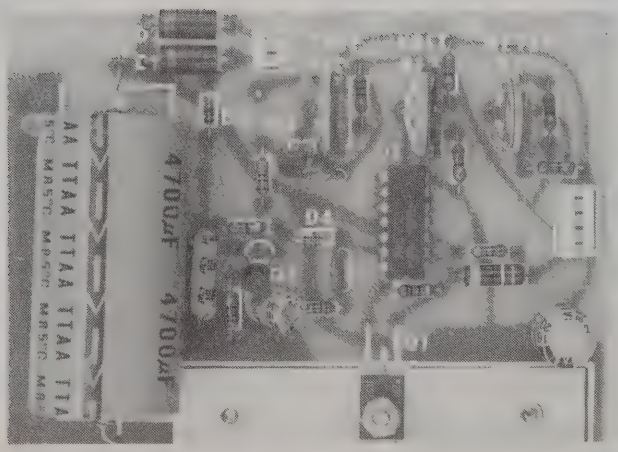
20 A Fuse
Q2
Regulator Board
Bridge Rectifier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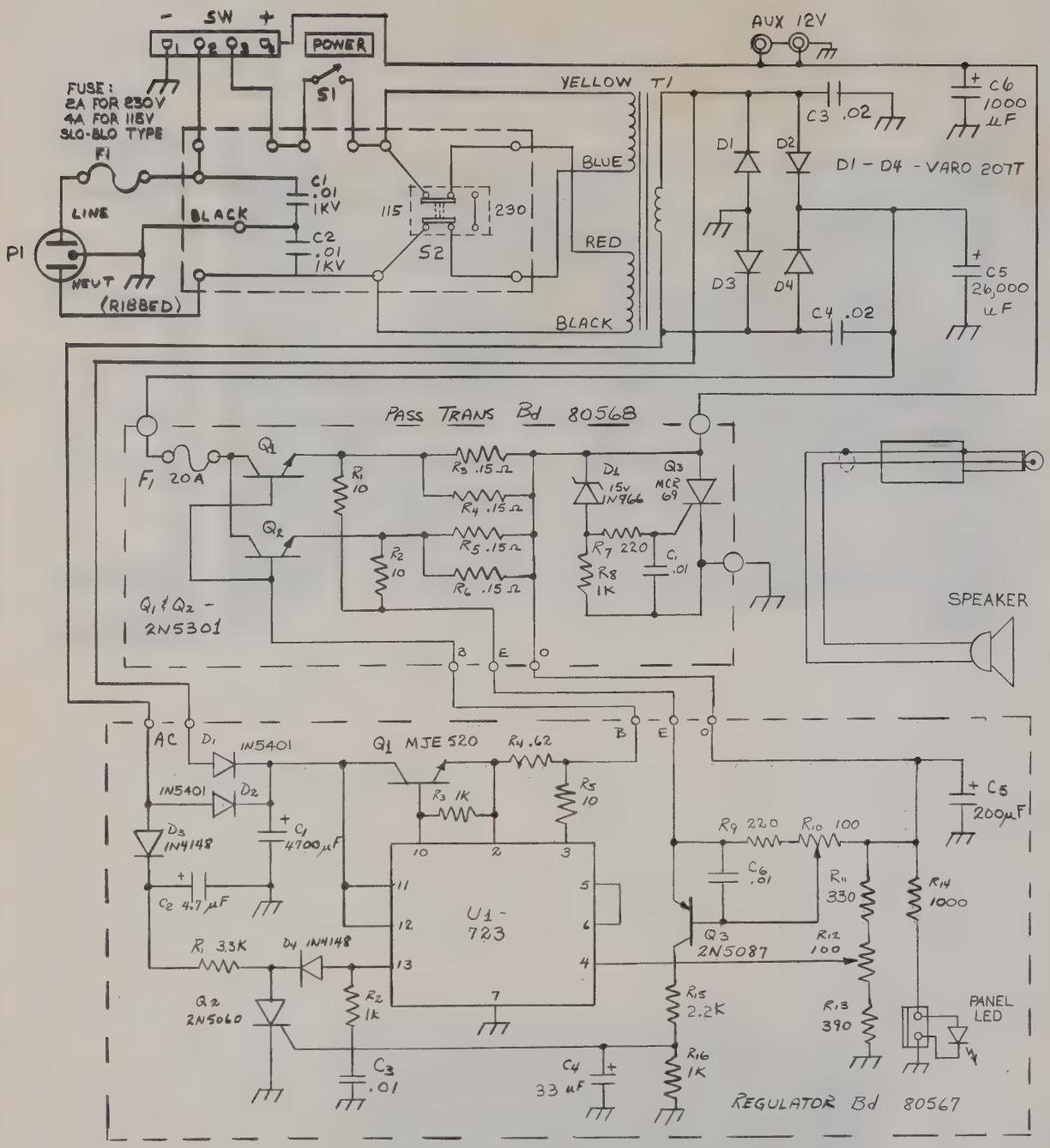

MODEL 260 POWER SUPPLY

11-1-82 RF

OWNER'S MANUAL

Model 260

TEN-TEC MODEL 260 POWER SUPPLY

GENERAL

The Model 260 Power Supply is designed to deliver 20A at 13.5V from a 115/230 V ac 50-60 Hz source. An electronic latching circuit breaker shuts off the output voltage when the current drawn from the supply exceeds 20 amperes. When this breaker trips, the power indicator LED goes out indicating loss of output. The breaker is reset by cycling the POWER switch from ON to OFF and back to ON. The primary circuit is fused with a 4 ampere fuse on 115 V ac. The output voltage is available through a four pin AMP connector at the end of a three foot power cord and at two phono type jacks for low current applications. The center two of the four AMP pins are used for remote power on-off switching. A 4w maximum ceramic magnet speaker is mounted on the front panel.

The circuit consists of a bridge rectifier followed by a high capacitance filter. This in turn, is followed by two parallel transistors in a series regulator circuit whose base voltage is derived from an integrated circuit regulator and driver transistor. The circuit breaker consists of a SCR latching circuit which turns off the regulator when the current drawn exceeds the set limit. The SCR triggering signal is developed across a pair of low value resistors in series with the output, which also serve to assure sharing of the load current between the two pass transistors. Overvoltage protection of the output is provided by a SCR "Crow-Bar" circuit which short circuits the output if it should rise above 16 V dc.

INSTALLATION

Output Cable and Connectors: The high current output should be drawn from the four pin AMP connector at the end of the output cable. Pin 1 is GND (black) negative, and identified by the rib on the plastic shell of the output connector. Pins 2 and 3 (white) are connected in series with the front panel POWER switch and are used with a remote on-off switch, if desired. Pin 4 is +13.5 volts (red).

If the supply is to be turned on and off only by the front panel switch, pins 2 and 3 should be jumpered together at the connector or where the two white wires attach to the terminal strip inside the unit. Keep interconnecting cables carrying high current as short as possible and of a wire gauge greater than or equal to #14. Sizable cable voltage drop will be experienced if too long or if a small wire size is used.

Provide a good interchassis connection by running a separate heavy braid or stranded wire between them, using the ground lugs provided on the rear panels. In rf communication systems, a connection from chassis to a good earth ground is also recommended.

The phono jacks marked AUX 12V are connected in parallel with the output from the AMP socket and may be used to power auxiliary equipment that does not draw more than five amperes. Center terminal is positive, shell is negative.

Speaker Cable: If you wish to use the built in speaker, insert the phone plug on the cable into the transceiver's ext. speaker jack.

When operating from 230 V ac, turn the 260 over and move the slide switch with a screwdriver blade so that "230" shows through the hole. Then replace the line fuse with the 2A slo-blo type contained in the packing kit.

OPERATION

1.) Connect the line cord to proper source of voltage. This is a three wire cable and the green center conductor should be connected to the main ground system. It is internally connected to the supply chassis.

2.) Connect load to AMP connector as described above.

3.) Turn unit on by pressing the top protruding edge of the POWER switch. The LED should indicate that output voltage is present. If it does not light, check load and cables for short circuit or excessive current situation.

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4.) The LED is powered from the regulated output of the supply and should not dim with the current loads up to the rated output. If pilot lamps in the driven equipment dim with increased load current,but the LED stays constant, it is an indication that a loss of voltage is occuring in the interconnecting cables or connectors. To remedy use shorter cable and/or larger wire size.

5.) To reset the circuit breaker after it has shut down the output voltage, turn the unit off and back on again. If the short or overload remains, the breaker will again shut down. Remove the cause of overload and reset again as before.

6.) If for some reason the crow-bar circuit should detect an over-voltage condition it will short the output voltage. If this was caused by a transient spike, the circuit breaker will trip out and must be reset as above. If the overvoltage condition is the result of a component failure, or the overcurrent breaker is inoperative, the internal 20 ampere fuse will open and reset will not be possible. If the internal fuse blows (mounted in fuse clips located on the heatsink circuit board), it indicates that possibly some internal part has failed and service may be required.

7.) Fuses: In the event that the line fuse blows, replace it with an identical type slo-blo. The line fuse holder is located on the rear panel next to the line cord strain bushing.

8.) Do not place the power supply in a closed area or in a small space where normal room air cannot circulate freely around the heat sink on the rear panel. This heat sink should have free access to normal air convection currents. For instance, do not place the supply on the floor in a corner. If this is the only available location, turn it around--fins out. Always operate the supply with the heat sink and fins vertical. Never put anything on top of the heat sink fins.

When operating near full load for relatively long periods of time, the heat sink will become quite hot. The bottom pan of the chassis will also become hot due to power dissipation in the bridge rectifier. The large heat sink is capable of maintaining this type of operation if the free air circulation requirements as above are met. If extended operation is anticipated, and/or the line voltage is above the mean value of 117, it's recommended that a small fan be used to circulate air around the heat sink. For normal CW or SSB Amateur applications, where the duty cycle is less than 60%, a fan should not be necessary. If there is any question as to whether there is enough air circulation around the heat sink, check the temperature of the heat sink. It should not be allowed to go above 100°C or 212°F. To do this, moisten the tip of your finger and touch lightly near one of the transistors on the heat sink. If it sizzles, its too hot.

SPECIFICATIONS

Input Voltage: 105-125 V ac, 50-60 Hz, or 210-250 V ac, 50-60 Hz.
Output Voltage: 13.5 V dc, adjustable 12.5 to 14.0 V dc.
Regulation: Better than 1% no load to full load @ 117 V dc.
Speaker: Ceramic Magnet, 8 ohm.
Output Current: 18 amperes, full load, 20 amperes, maximum.
Circuit Breaker: Electronic latching. Factory set at 20A.
Ripple: Less than 60 mV peak-to-peak at 18A at 117 V ac.
Construction: 16 ga. alumimum chassis and top.
Output Connectors: One 4 pin AMP MATE-N-LOC, two phono jacks for low current.
Size: HWD 5-1/4" x 7-1/2" x 13-1/2"including heat sink.
Weight: 15 lbs.

CIRCUIT DESCRIPTION

Model 260 Power Supply uses a series regulator type circuit incorporating two 2N5301 s as the pass elements. While either transistor could handle the 20A of output by itself, two are used with a generous heat sink to assure plenty of design margin. The .15 ohm resistors in each emitter assures that the load is equally shared between the two pass transistors. They are also used as the sense element for the over-current breaker.

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The circuitry is divided into three assemblies. The chassis contains the transformer and associated ac wiring, bridge rectifier, and filter capacitor. The regulator board contains all the control and drive circuitry. The pass transistor assembly is mounted on the rear heat sink and contains the pass transistors, shunt resistors and the overvoltage crow-bar and its fuse. For ease of service, these three assemblies are interconnected with cable plugs where current requirements permit.

REGULATOR BOARD

The heart of the Model 260 is a 723 integrated circuit voltage regulator. It contains a stable reference voltage source, feedback amplifier, over-current shutdown, and control circuits. The regulator board by itself is a 1 ampere current limited power supply and is used to drive the pass transistors on the heatsink for the required current output. The current sense voltage from the pass transistor board is returned to the regulator board betweens pins E and O. This signal is used to drive the over-current breaker. Potentiometer R10 sets the current trip point. Output voltage is adjusted by R12.

The regulator board has its own rectifier and filter capacitor. Diode D3 and capacitor C2 supply the hold-in current for SCR Q2 when the over-current circuit trips.

As received from the factory, the potentiometers are carefully adjusted for the following settings:

VOLTAGE	Set for 13.5 V dc.
TRIP	Set for 20A.

These should not require further adjustment unless service has been performed on the unit.

PASS TRANSISTOR BOARD

This board contains the series pass transistors. The two 2N5301 transistors are connected in parallel with the ballast resistors on each emitter. These resistors insure that the two transistors share the load current and also are used as current sensing shunts for the current trip circuit.

The crow-bar circuit occupies one corner of the board. If the output voltage should rise above 16 V dc, zener diode D1 will conduct and apply forward bias to the gate of SCR Q3. When Q3 latches, it shorts the supply output to ground, which will either cause the over-current circuit to trip or will blow F1, the 20A fuse.

IN CASE OF DIFFICULTY:

SYMPTOM	POSSIBLE CAUSE
No output when turned on (LED not LIT)	External AC switch not on. (switch between white wires of output cable) Line fuse blown.
No output but LED blinks at turn on	Output shorted.
Output voltage sags with load (LED dims)	Low line voltage. Blown 20A fuse.
Blown 20A fuse	Shorted pass transistor or accidental ground wire contact to transistor case on heatsink.

VOLTAGE READINGS---PASS TRANSISTOR BOARD

	C (a)	B (g)	E (cath)	
Q1	24.5	14.2	13.5	
Q2	24.5	14.2	13.5	no load, untripped
Q3	13.5	0	0	
Q1	24.5	0	0	
Q2	24.5	0	0	tripped due to overcurrent breaker
Q3	0	0	0	

VOLTAGE READINGS---REGULATOR BOARD (No load)

U1 Pin	723 Volt	I.C. Pin	Volt
1	NC	14	NC
2	14.2	13	16.0
3	14.2	12	24.5
4	7.1	11	24.5
5	7.1	10	14.8
6	7.1	9	NC
7	0	8	NC

NC=No Connection

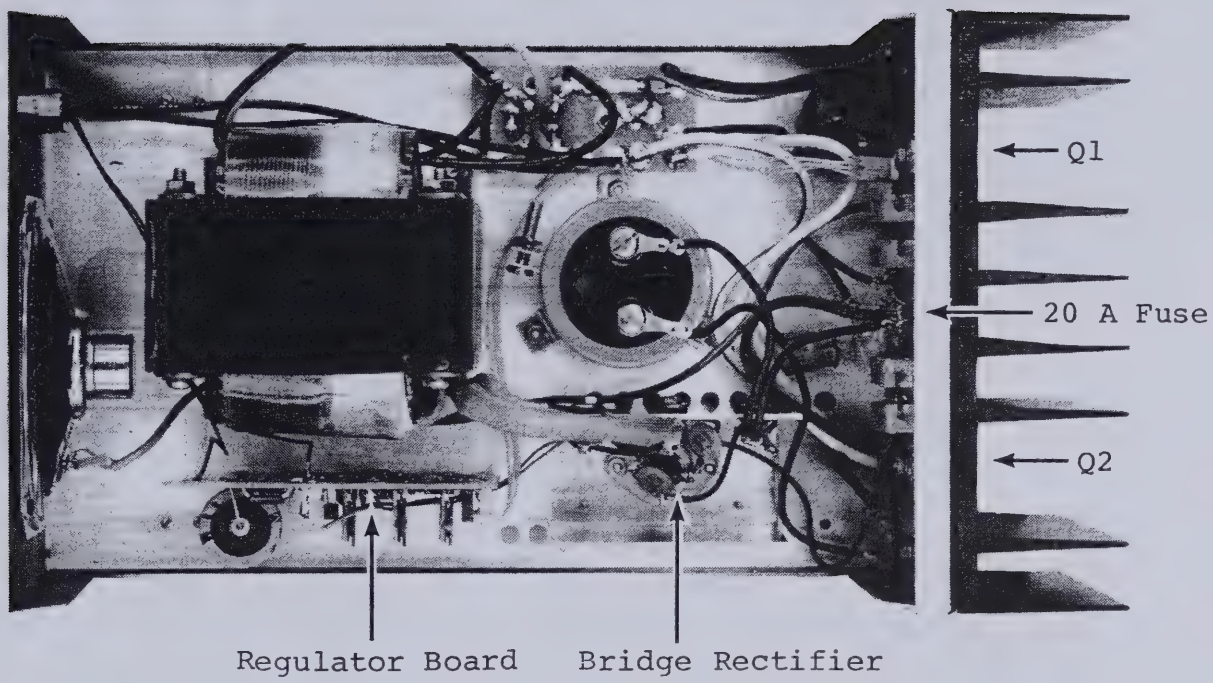
PIN--INNER CONNECTION SOCKETS

B (case)	14.2
E (emitter)	13.5
O (output)	13.5
AC-18 V ac	
Transistors (scr)	

NO LOAD

	C (A)	B (G)	E (cath)
Q1	24.5	14.8	14.2
Q2	24.5	0	0
Q3	0	13.5	13.5
Tripped by overcurrent			
Q1	24.6	.45	.45
Q2	.7	.75	0
Q3	.5	0	0

1st printing 4-260 10/82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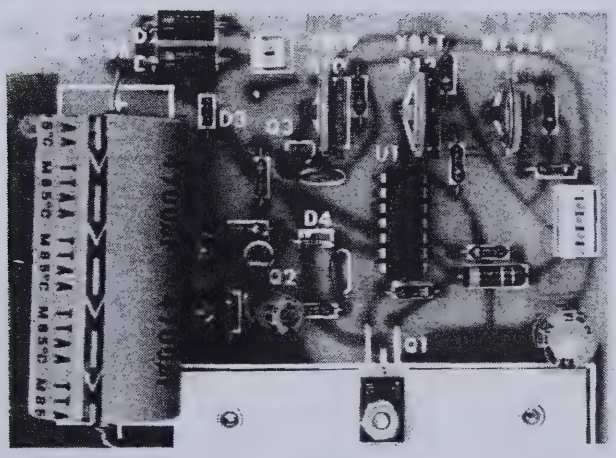
20 A Fuse
Q2
Regulator Board
Bridge Rectifier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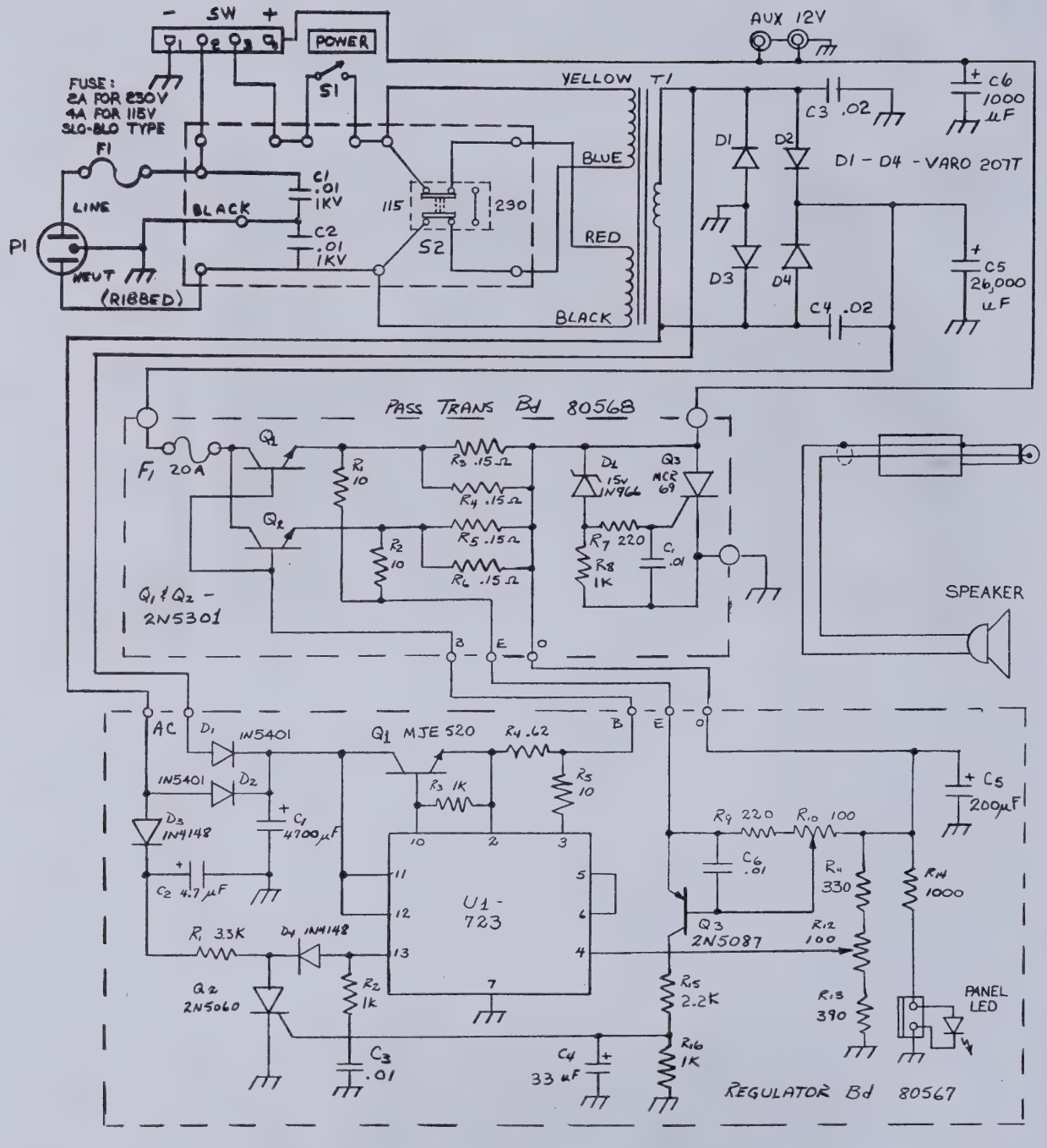


MODEL 260 POWER SUPPLY

11-1-82 RF

TEN-TEC MODEL 961 POWER SUPPLY/SPEAKER

GENERAL

The Model 961 Power Supply is designed to power the TEN-TEC models 560/561 and 585 transceivers. The supply delivers 20 Amps at 13.5 Vdc from a 115/230 Vac 50-60 Hz source. Circuit features include an electronic over-current sensor which shuts off the output if the current demand exceeds 22 Amps. The over-current shut down condition is reset by cycling the POWER switch from ON to OFF and back to ON. Output over-voltage protection is also included to prevent the output voltage from exceeding 16.0 Vdc.

The output voltage is available through a 4 x 14 gauge 3 foot cable and connector. The cable carries +13.5 Vdc, ground and the "hot" side of the ac primary and mates directly to the POWER jack on the 560/561 and 585 transceivers. Two RCA phono jacks on the back of the supply also provide +13.5 Vdc for low current (2 or 3 amps) auxiliary applications.

INSTALLATION

Any high current connections should be made at the 4 pin connector at the end of the output cable. Pin 1 (black wire) is the chassis ground and high current return. It is identified by a rib on the plastic shell of the connector. Pins 2 and 3 (white wires) are connected in series with the front panel POWER switch and carry the "hot" side of the the 115/230 Vac line. These two lines facilitate remote ON/OFF switching of the power supply. Pin 4 (red wire) is the +13.5 Vdc output.

If the supply is to be used with equipment other than TEN-TEC transceivers, pins 2 and 3 must be connected together to turn on the supply. These two pins are at 115/230 Vac and carry up to 3 Amps under full load. If the cable length must be extended for some application, a heavy gauge wire, at least #14, must be used. Significant voltage drops can occur even in heavy cable with a 20 Amp load. When using the supply with the 560/561 or 585, provide a good interchassis connection by running a separate heavy braid or wire between the ground posts on the rear panels. In rf communication systems, a connection from chassis to earth ground is simply good practice.

The phone jacks marked AUX +13.5 V are connected in parallel with the high current output cable. Each may be used to power auxiliary equipment that does not draw more than 3 Amps. The center terminal is positive, the shell is ground.

If you wish to use the built-in speaker, insert the 1/4" phone plug, cabled through the back of the supply, into the EXT SPKR jack of the transceiver.

230 Vac OPERATION

Before operating the supply from 230 Vac, the line voltage selector switch on the left side of the supply must be moved with a screwdriver blade to display "230". Replace the back panel line fuse with the MDL 2 type fuse included in the packing kit.

SPECIFICATIONS

Input Voltage: 105-125 Vac or 210-250 Vac, 50-60 Hz.

Output Voltage: 13.8 Vdc, internally adjustable from 11.5 to 15.0 Vdc.

Output Current: 20 Amps full load, 22 Amps maximum for 5 minutes.

Current Limiting: Electronically disables output. Factory set threshold at 22 Amps.

Regulation: - 3% at output connector for no load to 20 Amps full load.

Ripple: 20 mV peak to peak at 20 Amps.

Speaker Impedance: 8 ohms.

CIRCUIT DESCRIPTION

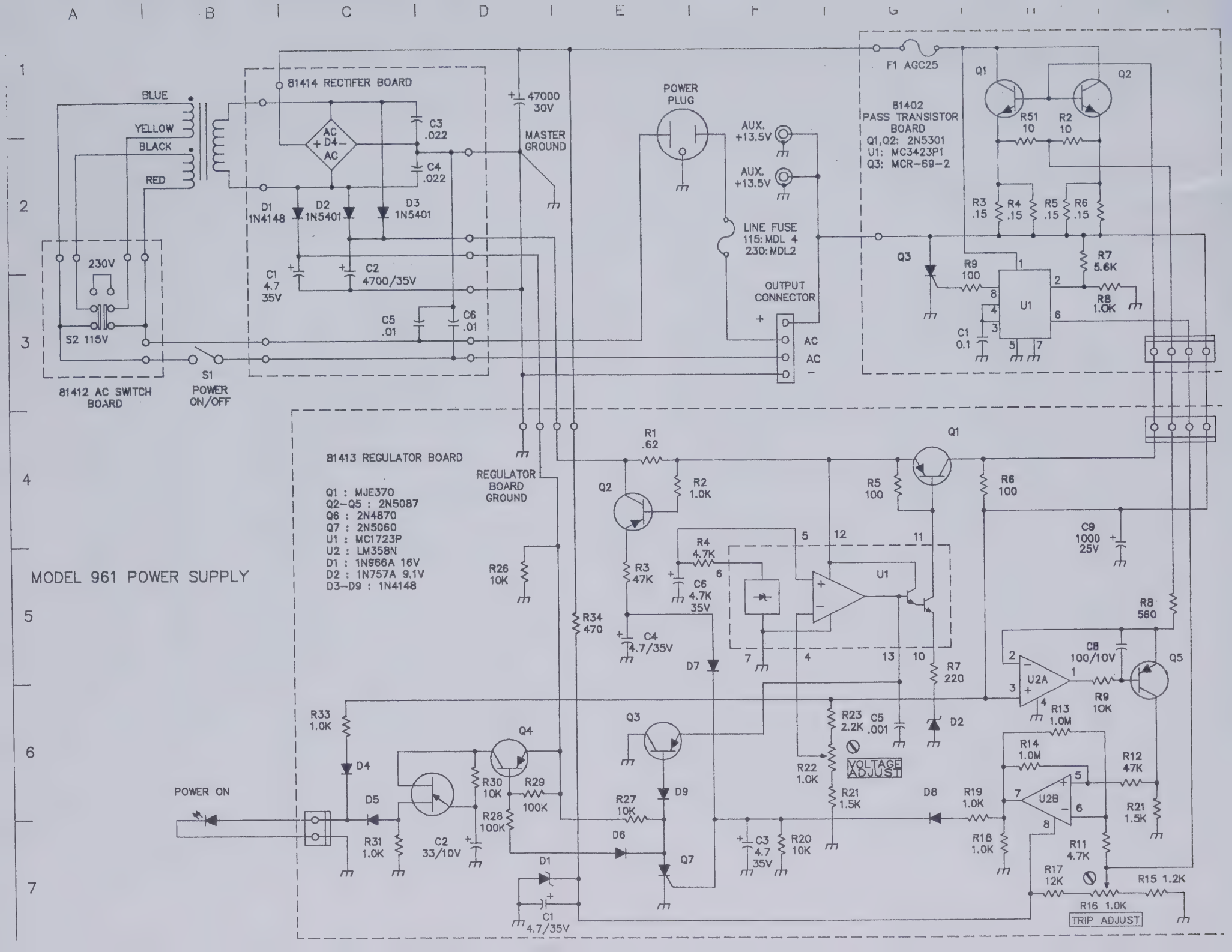
The Model 961 uses a linear series regulator type circuit based on the '723 regulator chip and two 2N5301 pass transistors.

The "hot" side of the AC mains is fused by the rear panel line fuse, then sent down the heavy 4 conductor cable where a jumper or switch at the load end of the cable connects pins 2 and 3. Pin 3 leads back to the POWER switch and on to the dual primaries of transformer T1. The voltage selector switch on the left side of the 961 configures the transformer primary windings for either 115 or 230 Vac.

The secondary of T1 feeds high current bridge rectifier D4 which develops unregulated dc for the pass transistors. Separate rectifiers D2 and D3 provide dc power for the regulator circuit. Regulator chip U1 compares a sample of the output voltage from R22 to an on-chip reference voltage. Any difference between the output and reference voltages is amplified and used to correct the bias on transistor Q1. Current from Q1 then drives the bases of pass transistors Q1 and Q2 on the pass transistor board.

The over current shut down circuit consists of a current to voltage converter U2A and Q5, a comparator U2B and SCR latch Q7. Output current is sampled across the .15 ohm emitter resistors on the pass transistor board. The 0-20 amp current sample is converted to 0-2.0 Vdc at the collector of Q5. Comparator U2B checks the current measurement against the trip-out setting at R16. When over current occurs U2B goes high and triggers Q7. The SCR shuts down the regulator by turning on Q3. To reset the supply the holding current through Q7 must be interrupted by turning off the POWER switch.

Over-voltage protection is implemented by U1 and Q3 on the pass transistor board. If the output voltage exceeds the preset limit of 16.0 Vdc, U1 will trigger SCR Q3 into conduction and either trip the over-current circuitry or blow the internal 25 Amp fuse F1.


MODEL 961 POWER SUPPLY
81414 RECTIFER BOARD
81412 AC SWITCH BOARD
81413 REGULATOR BOARD
81402 PASS TRANSISTOR BOARD
Q1,Q2: 2N5301
U1: MC3423P1
Q3: MCR-69-2
Q1 : MJE370
Q2-Q5 : 2N5087
Q6 : 2N4870
Q7 : 2N5060
U1 : MC1723P
U2 : LM358N
D1 : 1N966A 16V
D2 : 1N757A 9.1V
D3-D9 : 1N4148
BLUE
YELLOW
BLACK
RED
230V
S2 115V
S1
POWER ON/OFF
POWER PLUG
F1 AGC25
LINE FUSE
115: MDL 4
230: MDL2
AUX. +13.5V
AUX. +13.5V
OUTPUT CONNECTOR
MASTER GROUND
REGULATOR BOARD GROUND
47000 30V
C3 .022
C4 .022
D1 1N4148
D2 1N5401
D3 1N5401
C1 4.7 35V
C2 4700/35V
C5 .01
C6 .01
R1 .62
R2 1.0K
R3 47K
R4 4.7K
C6 4.7K 35V
C4 4.7/35V
R26 10K
R34 470
R5 100
R6 100
C9 1000 25V
R8 560
C8 100/10V
R9 10K
R13 1.0M
R7 220
D2
R23 2.2K
C5 .001
VOLTAGE ADJUST
R22 1.0K
R21 1.5K
R14 1.0M
R12 47K
R21 1.5K
R19 1.0K
R18 1.0K
R11 4.7K
R17 12K
R15 1.2K
R16 1.0K
TRIP ADJUST
R33 1.0K
D4
D5
R31 1.0K
C2 33/10V
R30 10K
R29 100K
R28 100K
R27 10K
D9
D6
D1
C1 4.7/35V
C3 4.7 35V
R20 10K
D8
POWER ON
R51 10
R2 10
R3 .15
R4 .15
R5 .15
R6 .15
R7 5.6K
R8 1.0K
R9 100
C1 0.1
U1
U2A
U2B
Q1
Q2
Q3
Q4
Q5
Q7

TEN-TEC MODELS 261 & 262G POWER SUPPLIES

GENERAL

Ten-Tec Models 261 and 262G Power Supplies are deluxe versions of the Models 251 and 252G supplies, respectively. In addition to the basic supply function of providing regulated DC voltage of approximately 12.5 volts from a 115 volt AC source, these units incorporate a Voice Operated Transmitter (VOX) system of improved design and a large station speaker. Model 261 is intended for use with the Argonaut/ Model 405 Transceiving system, and the Model 262G with the Triton transceiver.

The power supply sections of these units are identical with their 251/252G counterparts, and installation, operating and maintenance information is contained in the Owner's Instructions for these models, which is included in, and a part of these instructions.

The VOX circuit is of an improved design, requiring no anti-vox adjustments. This is accomplished by processing the speech signal through a narrow bandpass active filter centered around 200 Hz. Only this component is used to activate the transmitter. By so doing, practically all of the speech components picked up by the microphone from the station speaker, (which are considerably above 200 Hz), have no effect on the transmitter switching circuits. Only those coming directly from the operator's voice or room sounds, (which do contain 200 Hz components), will activate the T/R circuits. This system also has the advantage that the de-sensitizing effects in the microphone channel, encountered as a result of the anti-vox circuit in ordinary VOX systems, are not present in this system. An adjustable delay control selects the amount of time the transmitter holds in after speech ceases, to eliminate T/R switching between words.

INSTALLATION

1.) Power Connections: See Owner's Instructions for Models 251/252G.

2.) VOX connections:

A.) Insert plug on rear cable marked MIC into the MIC jack on the rear of the Ten-Tec Triton or Argonaut transceiver.

B.) Insert microphone plug into MIC jack on front of the power supply. The microphone plug should be a three contact, (stereo) type of 1/4" diameter barrel. Microphone cable should be well shielded type. Connect shield, (GND), to barrel and microphone signal wire to the band terminal. If a PTT switch is included in the microphone, and occasional PTT operation is desired, connect the PTT switch lead to the ball terminal of the stereo plug. It is recommended that the PTT lead also be shielded to prevent rf pickup. The PTT switch should be of the SPDT type, which shorts the microphone element out in the "receive" position. With this arrangement, the VOX system can easily be disabled by throwing the PTT switch to the "receive" position. Hence no mic signal will be applied to the VOX circuits.

C.) If no PTT switch is incorporated in the mic, or if it is desired that the front panel PTT control switch be used as a "transmit" switch, connect a jumper wire in the phone plug between the ball terminal and ground terminal. This, in effect, enables the PTT front panel control switch to act as a "transmit" switch whenever it is pulled out.

3.) Station Speaker Connections:

A.) If it is desired to use the larger speaker, it is only necessary to plug the cable marked SPEAKER into the PHONES/SPEAKER jack on the rear of the transceiver. It is <u>not necessary</u> that the Model 261/262G speaker be used with VOX operation.

B.) To connect headphones, insert their cable into the jack on the front panel marked PHONES. This will disable the internal speaker.

OPERATION

Front Panel Control Adjustments

DELAY - PTT: With the knob "in", the VOX system is operable. Clockwise rotation of the control increases the delay time after speech ceases until the transmitter circuits revert to the "receive" mode. With normal speech, the time should be adjusted so that the transmitter does not turn off between words. Otherwise some clipping of the first syllables in some words will be noticed. If the microphone incorporates a PTT switch, and it is wired into the circuit as outlined in the section on INSTALLATION, this type of operation can be accomplished by pulling the control knob out. Notice: When using PTT, rotate either the DELAY or VOX-GAIN control fully counterclockwise to defeat the time delay that will occur after switching the PTT switch off. If the microphone plug is wired with a short between the PTT terminal and ground, pulling the knob out will turn the transmitter on. The knob can be used as a station "transmit" switch.

VOX-GAIN: This control only affects the gain of the audio channel that controls the T/R functions. It does not affect the level of the audio signal going to the transmitter, since this is preset for unity gain. Successful VOX performance is directly related to the proper setting of this control. The VOX-GAIN should be advanced just far enough to reliably trip the transmitter on, but not so far that ambient room noises or incidental sounds do. One method of adjustment is to place the microphone twice the normal distance away from the mouth and while talking in the mic, advance the VOX-GAIN control until the transmitter turns on with every word. This is best adjusted with the DELAY control fully counterclockwise. Then, at normal talking distance, the VOX system should work reliably. Advance the DELAY control for "hold-in" between words. For reliable VOX operation, please observe the OPERATING TIPS given below.

VOX Operating Tips

1.) Most reliable operation is achieved when using headphones. Then, VOX-GAIN control setting is less critical.

2.) If speaker operation is desired, use close talking microphone. This also eliminates accidental transmitter turn-on from incidental background sounds.

3.) Maintain largest speaker-to-microphone distance possible. Even though 200 Hz components from speaker are highly attenuated, it is possible that in some instances they are strong enough to trip the VOX system -- particularily when the VOX-GAIN control is advanced.

4.) Advance speaker level only far enough for good copy. Excessive speaker level may trip VOX circuit.

5.) In some instances internal speaker in transceiver may provide better anti-vox performance than large speaker. This may be due to a more favorable speaker-to-microphone placement, or a higher frequency cutoff in the small speaker.

6.) In overly reverberant rooms, use of a unidirectional microphone may improve performance.

7.) DELAY control should be advanced far enough to eliminate syllable clipping on every word.

8.) Speak up into microphone in loud, firm tone.

CIRCUIT DESCRIPTION

The VOX circuit is contained on a single P.C. circuit board which plugs into two 7 pin chassis sockets. Referring to the schematic attached, it functions as follows:

Transistors Q1A, Q1B and Q2 form a very high impedance direct coupled preamplifier, preceeded by an rf filter, R2 and C2. The high impedance input is necessary to preserve the low frequency components from the microphone, especially in the 200 Hz range. Output from this amplifier is taken from the collector of Q2, and is reduced down to unity gain by resistance divider R9 and R10. Output from the divider

is connected to the band terminal of the stereo type phone plug, and thus to the MIC input jack of the transceiver. Transistor Q3A is an electronic switch across this signal line that shorts whenever the T/R line to the transceiver is in the "receive" mode, i.e. when there is a positive DC voltage of from 6 to 13 on the T/R line from the transceiver. This prevents the microphone from being connected into the transceiver receiving circuits, the same as the SPDT push-to-talk switch does when VOX is not used.

The output from the preamplifier is also applied to the VOX-GAIN control via C8 and C10, and then to the two stage active filter consisting of integrated circuit IC-1. The narrow range of output frequencies centered around 200 Hz is converted into two positive going DC voltages by diodes D1 and D2. The voltage from the D2 network is applied to the base of Q4A. Q4A and Q4B make up a bi-stable flip-flop. When the processed audio from the filter is applied as a positive voltage to Q4A, this transistor is turned on, thereby turning Q4B off. When this occurs, the collector voltage of Q4B is at a high state, and this high voltage biases Q3B on. Q3B, when conducting, shorts the T/R line from the transceiver to effective ground, thereby turning the transmitter circuits on. This also results in Q3A becoming an open circuit and thereby permits the microphone signal to be applied to the transceiver MIC input circuit.

The bistable flip-flop will remain in this state, even if the positive base voltage (hence audio from the mic) returns to zero. The flip-flop regains its original state upon application of a pulse to Q4A's emitter from the delay timing oscillator, Q6. This pulse occures after a preset time determined by the charging of C20 through the DELAY control R37 and resistor R32. Q6 is a unijunction relaxation oscillator whose frequency of operation is determined by the RC time constant of C20, R37 and R32. Provided both Q5A and Q5B are in the off state, C20 will start charging toward the +12 volts through the two resistors. When the voltage across C20 reaches approximately 6 volts, the unijunction transistor, Q6, will start to conduct, and discharge C20 through its lower junction and R30 in the emitter of Q4A. The positive pulse across R30 flips Q4A into non-conduction and Q4B into a conducting state. This situation removes the short from the T/R line and places the system back into the receive mode -- until positive voltage is again applied to the base of Q4A. The delay time after speech ceases, then, is controlled by the setting of the DELAY control.

Q5A and Q5B constitute a logic NOR circuit. Both base voltages have to be in the low state before the delay circuitry can function. If either or both bases go positive, the voltage at their common collector will be practically zero, and C20 is prevented from charging and tripping the bi-stable flip-flop back to the receive mode. The base of Q5A senses the state of Q4A, so that the delay circuit will only function when Q4A is conducting, i.e. when the circuit is in the transmit mode. Also, the base of Q5B senses the presence of speech being processed, since its voltage is derived from the rectification of the speech components by diode D1. The delay circuit will not function so long as speech is present in the system. The only logic that will allow the delay circuit to function and provide the "righting" pulse to the bi-stable flip-flop is that speech is not present, and the circuit is in the transmit mode. Only then, after the predetermined delay time, will circuit switch back to the receive mode.

In the event that Q5A and Q5B are both off for a period of time less than the delay time, so that C20 does not reach its firing potential, before speech is again processed to turn Q5B on, it is desirable that the accumulated charge on C20 be quickly discharged so that a full delay time period may be restarted when the NOR circuit allows it. To do this, diode D3 and limiting resistor R35 provide a low impedance path through conducting Q5B to discharge C20. (D3 is back-biased during the normal charging cycle and presents a high impedance to the circuit).

In order to prevent ground loops from the high DC currents in the common ground circuit between transceiver and power supply, the low level VOX microphone circuits are all raised from the supply chassis and grounded only through the cable shield going to the transceiver. To check the circuit performance of the VOX system without having the transceiver connected, it is necessary to provide a ground connection between the cable shield circuit and the supply chassis.

NOTICE: This VOX circuit provides transistor T/R switching for the Ten-Tec line of transceivers. The T/R line requires a positive voltage between 6 and 13 volts in the receive mode and a grounded line in the transmit mode. Impedance of the T/R line should be greater than 1 Kohm. Transceivers with other than these T/R characteristics

cannot be used with this VOX circuit.

SPECIFICATIONS

1.) Power Supply Sections: Refer to Model 251/252G Instructions.

2.) VOX Section:

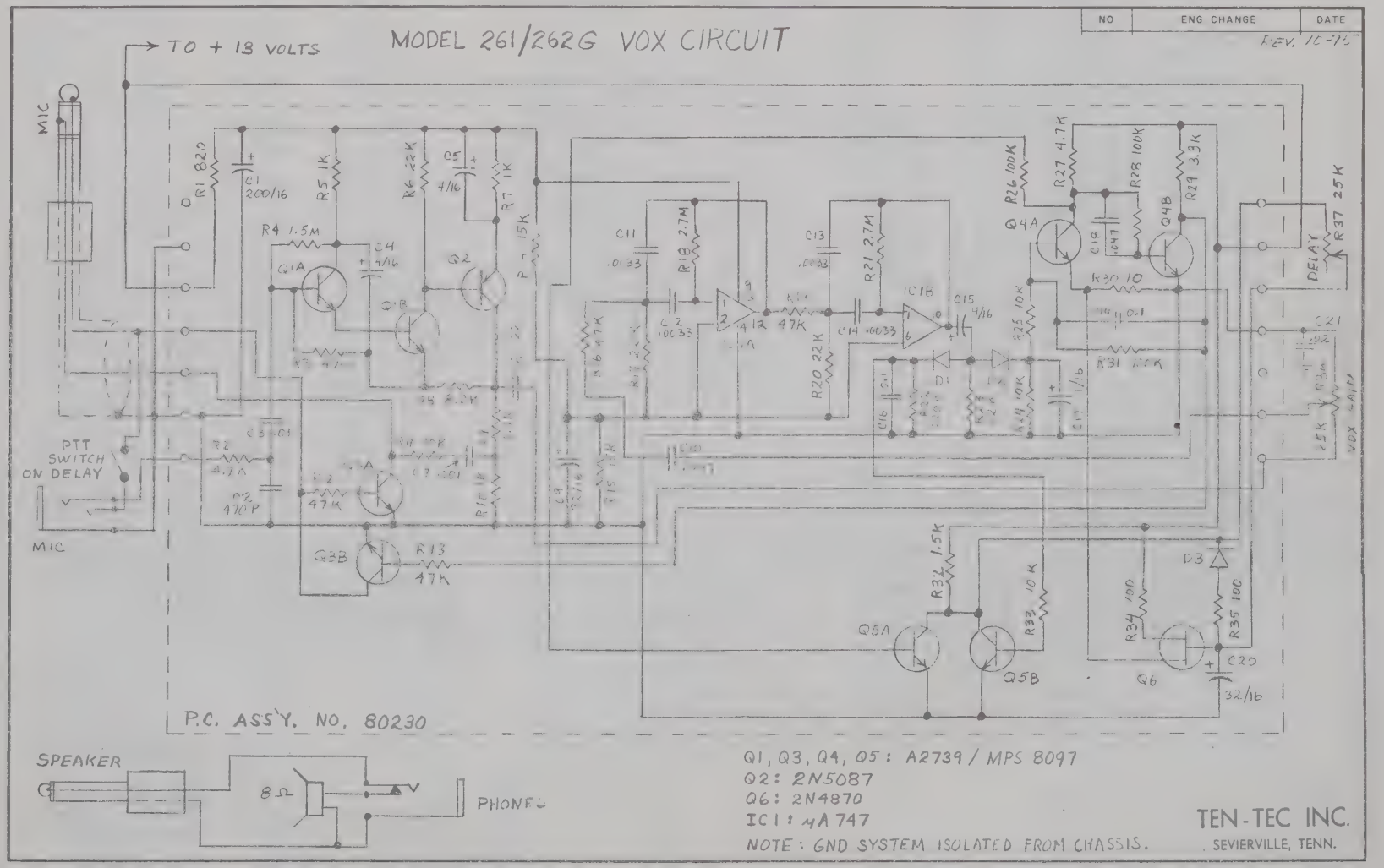
Power Required: 13 VDC @ 8 mA.
Microphone Input Impedance: Greater than 3 Megohms.
Transmitter Microphone Channel Gain: Unity.
Maximum Microphone Input Level: 250 mV.
Sensitivity of VOX Channel: Less than 1 mV @ 200 Hz trips T/R.
Delay: Adjustable from 0.1 to 1.0 sec.

3.) Physical:

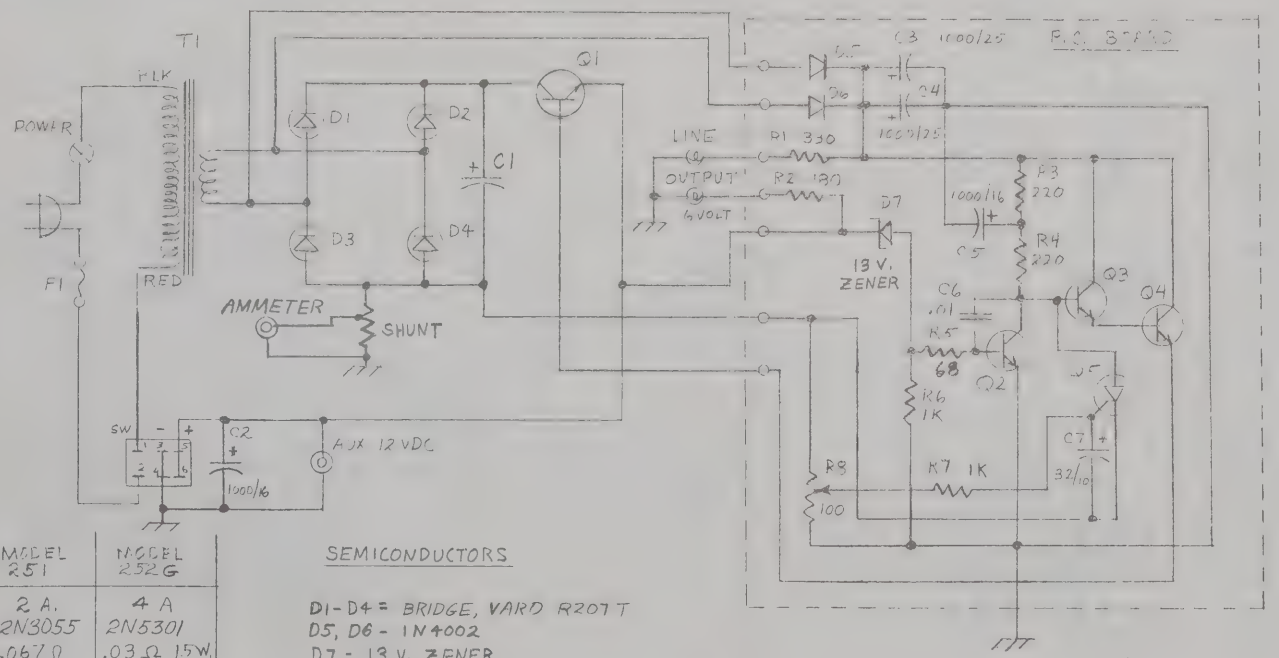
Size: HWD 4-1/2" x 9-1/4" x 13"
Weight: Model 261 - 11 lbs.; Model 262G - 14-1/2 lbs.
Construction: Aluminum chassis with molded plastic side panels.

SERVICE and WARRANTY

See Owner's Instructions for Model 251/252G Power Supplies.


MODEL 261/262G VOX CIRCUIT
NO
ENG CHANGE
DATE
REV. 10-75
TO + 13 VOLTS
MIC
PTT SWITCH ON DELAY
MIC
R1 820
C1 200/16
R5 1K
R6 22K
C5 4/16
R7 1K
R4 1.5M
C4 4/16
Q1A
Q2
Q1B
R11 15K
C11 .0033
R18 2.7M
C12 .0033
R16 47K
R17 2.2K
C13 .0033
R21 2.7M
C14 .0033
R20 22K
R19 47K
IC1A
IC1B
C15 4/16
R26 100K
Q4A
R27 4.7K
R28 100K
R29 3.3K
Q4B
C18 .047
R30 10
R25 10K
R31 22K
C16 .01
D1
D2
R24 10K
C17 1/16
DELAY
R37 25K
C21 .02
R36 25K
VOX GAIN
R2 4.7K
C3 .01
C2 470P
R8 47K
Q3A
R14 10K
C7 .001
R10 1K
C8 33/16
R15 10K
Q3B
R13 47K
R32 1.5K
R33 10K
Q5A
Q5B
R34 100
Q6
D3
R35 100
C20 32/16
P.C. ASS'Y. NO. 80230
SPEAKER
8Ω
PHONES
Q1, Q3, Q4, Q5: A2739 / MPS 8097
Q2: 2N5087
Q6: 2N4870
IC1: μA 747
NOTE: GND SYSTEM ISOLATED FROM CHASSIS.
TEN-TEC INC.
SEVIERVILLE, TENN.

NO.	ENG. CHANGE	DATE
		REV. 11 75



SYM.	MODEL 251	MODEL 252G
F1	2 A.	4 A
Q1	2N3055	2N5301
SHUNT	.067Ω 8 W.	.03 Ω, 15W.
C1	13,000 M	26,000 M

SEMICONDUCTORS

D1-D4 = BRIDGE, VARO R207T
D5, D6 - 1N4002
D7 - 13 V. ZENER
Q2, Q3 - MPS U01
Q4 - 2N3055
Q5 - 2N5060

MODELS 251 AND 252G POWER SUPPLIES

TEN-TEC INC.
SEVIERVILLE, TENN.

TEN-TEC MODELS 251 & 252G POWER SUPPLIES

GENERAL

The TEN-TEC Model 251 Power Supply will deliver up to 9 amperes at approximately 13 VDC, regulated, from a 117 VAC 50-60 Hz source. An electronic latching circuit breaker shuts down the output voltage when a current in excess of 10 amperes is drawn from the supply. Reset is accomplished by cycling the POWER switch. Two indicator lamps monitor the LINE and OUTPUT voltages. The primary circuit is fused with a slo-blo fuse. The output voltage is available through a six pin Jones connector and a phono type jack for low current applications. Two of the six Jones pins are used for remote power on-off switching, if desired.

The Model 252G is similar to the Model 251 except that it will deliver up to 18 amperes at approximately 13 VDC. The circuit breaker in this model is factory set to trip at 20 amperes, and the line fuse rating is twice that of the Model 251. Either model will accept Model 207 Ammeter.

The circuit consists of a bridge rectifier, followed by a high capacitance filter. This, in turn, is followed by a series type transistor regulator whose base voltage is derived from a three transistor regulator. The "crow-bar" type circuit breaker consists of a SCR which removes the base voltage from one of the regulator transistors when fired. The SCR signal is developed across a low value sampling resistance in series with the load.

INSTALLATION

1.) Output Cables and Connectors - The high current output should be drawn from the six pin Jones connector. Pins 3 and 4, the two vertical center pins are negative GND, and are marked on the chassis with a -sign. Pins 5 and 6, the two vertical pins nearest the end panel and marked +, are the positive terminals. Pins 1 and 2 are connected in series with the POWER switch and are used with a remote on-off switch, if desired. If the supply is to be turned on and off only by the front panel switch, pins 1 and 2 should be jumpered together in the plug. The unit will be inoperative without this jumper, or if the plug is removed from the socket. Keep interconnecting cables carrying the high current as short as possible, and of a wire gauge greater than, or equal to #14. Sizable cable voltage drop will be experienced with long cables and/or small wire sizes. Always jumper the two pins available for the minus together and the two for the plus, to reduce pin resistance to a minimum.

   Provide a good interchassis connection by running a separate heavy braid or stranded wire between them, using the ground lug terminal provided near the output connectors. In rf communication systems, a connection from chassis to a good earth ground is also recommended.

   The phono jack marked AUX. 12V is connected in paralled with the output from the Jones socket and may be used to power auxiliary equipment that does not draw more than 1 ampere. Center terminal is positive, shell is negative.

2.) Models 251/E and 252G/E - These models have a dual primary winding on the power transformer, permitting operation from either 115 or 230 VAC. They are factory wired for 230 volt operation and do not have plugs on the line cords. To change from 230 to 115 volt primary, see instructions printed on the inside cover of the supply.

3.) Model 207 Ammeter - The upper phono jack marked AMMETER accepts the cable attached to the Model 207 Ammeter. This meter utilizes the internal shunt resistance of the supply and because of this, requires no alteration when used with either the 9 or 18 ampere supply. Just read the appropiate scale.

OPERATION

1.) Connect line cord to proper source of voltage, and load to output connectors as described above.

2.) Turn unit on by pressing the push POWER switch. The two lamps should indi-

cate that both LINE and OUTPUT voltages are present. If OUTPUT lamp does not light, check load and cables for short or excessive current situation.

3.) If the load current is variable, some dimming of the LINE lamp may be observed. The OUTPUT lamp, however, monitors the regulated voltage and should not dim with current drains up to rated values. If pilot lamps in the driven equipment dim with increased load current, but OUTPUT lamp does not, it is an indication that a loss of voltage to the load is present in the cables. To remedy, use shorter cables and larger wire size.

4.) To reset the circuit breaker after it shuts down the OUTPUT voltage, as monitored by its pilot lamp, turn unit off and wait approximately three seconds. Then switch unit on again. If the short or overload remains, the breaker will again shut the unit down. Remove cause of overload and reset as before. It is necessary to wait several seconds to allow the circuit capacitors to discharge sufficiently for proper resetting.

5.) Fuses - In the event that the line fuse blows, replace with an identical type Slo-Blo.

Model 251 - 115 VAC operation: 2A.
Model 251/E - 230 VAC operation: 1A.
Model 252G - 115 VAC operation: 4A.
Model 252G/E - 230 VAC operation: 2A.

6.) Do not place power supply in a small volume where normal room air cannot reach the heat sink mounted on the rear panel. This heat sink should have free access to normal convection air currents. When operating the supplies near rated full load for relatively long periods of time, the heat sink will become very warm, and in the case of the Model 252G can approach temperatures of approximately 200° F. If extended operation is anticipated and/or the line voltage is above the mean values or 115 or 230, it is recommended that a small fan be used to circulate air around the heat sink fins. For normal CW or SSB Amateur communications applications, where the duty cycle is no greater than 60%, no extraordinary precautions need be taken in this regard.

Specifications Common to Models 251 & 252G

Input Voltage: 117 VAC, 50-60 Hz.
Output Voltage: 13 VDC, ± 0.5V. Regulated.
Regulation: Better than 1%, no load to full load @ 117 VAC.
Construction: Aluminum with molded plastic side panels.
Output Connectors: One 6 pin Jones type.
One Phono jack for low current.
One Phono jack for Model 207 Ammeter.

Specifications for Model 251

Output Current: 9 amperes continuous, full load.
10 amperes, maximum.
Circuit Breaker: Electronic latching. Factory set to trip at 10 A.
Ripple: Less than 25 mV, peak-to-peak @ 9 A and 117 VAC.
Size: HWD 4½" x 8¼" x 8".
Weight: 9½ lbs.

Specifications for Model 252G

Output Current: 18 amperes continuous, full load.
20 amperes, maximum.
Circuit Breaker: Electronic latching. Factory set to trip at 20 A.
Ripple: Less than 60 mV, peak-to-peak @ 18 A and 117 VAC.
Size: HWD 4½" x 8¼" x 13".
Weight: 14½ lbs.

ORIGINAL

TEN-TEC SERVICE NOTE SN-2-262

Subject: Erratic VOX Operation in High RF Fields.

We have had a number of field reports of erratic or distorted VOX operation when using the Model 262G Power Supply with the TRITON transceiver. The problem is more prevalent when high power linears are used, although some TRITONs running barefoot showed similar problems. In every case, running the transmitter into a dummy load did not show any symptoms of malfunction. Hence the cause of the erratic operation was traced to RF energy feeding back into the VOX circuits.

Although this type of problem is not easily solved with a single modification, since each setup is unique in the strength and mode of RF pickup, the following suggestions were found to be helpful in reducing, if not completely eliminating the problem. One or more of them may be of help to you.

EXTREMELY IMPORTANT

1.) Rearrange the grounding system. Make sure that the chassis of the power supply is tied to the TRITON chassis and to a good earth ground. Lugs on the rear panels of the units are provided for this. Use heavy wire or shield braid such as that obtained from a piece of RG-8/U cable.

2.) Locate any source of high RF as far from the TRITON and Power Supply as possible. Such items as antenna tuners and matching sections should be well shielded and remote from the transmitting equipment. Open wire feed lines are also sources of high RF in the shack.

3.) Use a good RF line filter on the AC coming into the shack and especially on the line to Model 262G. Ground the by-pass capacitors in the filter to a good earth ground.

4.) Add .01 mfd, 1000 volt ceramic capacitors from each side of the AC line to the Model 262G chassis where the line feeds into the chassis. (This has been added to production units made after April 20, 1976.)

5.) Replace the zip cord type speaker cable used in early models of the Model 262G with a shielded lead. Try grounding the shield first at the TRITON speaker plug only and then at the Power Supply chassis only, and finally at both locations. Use the grounding location that proves best. (Production after April 20, 1976 has shielded cable.)

6.) If headphones are used, place a .01 mfd capacitor across the phones, either in the phone plug or at the phone jack on the TRITON (AUDIO jack) or Model 262G (PHONES jack).

7.) Try shielding the power cable from the Model 262G to the TRITON. Again try grounding the shield at either end to find best location. (A quick check to see if this step will help is to wrap the cable in aluminum foil and ground the foil.)

8.) Check microphone cable to see that it is well shielded. (Some spiral wrapped shielding is not a good RF shield. Braided shield is preferred.) If PTT lead is outside of shield, try cable that has this lead within the shield. (Again, aluminum foil wrapped tightly around the mike cable and grounded will indicate if this step will help.)

9.) If you find that by advancing the VOX GAIN control the delay circuit does not hold the transmitter on for the intended period of time, but rather goes into a transmit/receive mode with each syllable, the addition of a 0.1 mfd capacitor from the collector of Q4B to ground on the VOX PC assembly should correct this. The small capacitor can be tacked to the bottom pattern of the board, using short leads and tubing on the leads to prevent shorts. (Production units after April 20, 1976 have this addition.)

10.) In earlier model TRITON IVs, the PTT jack on the rear panel did not have a by-pass capacitor to chassis. This capacitor, a .01 mfd, should be added if unit does not have it. Also, the three ground lugs on the phono jacks marked PTT, KEY and SIDETONE should have wires run between them and also be gfounded to the chassis pan under them. It may be necessary to drill a small hole in the chassis to attach a GND lug. Use same lug to ground one lead of .01 mfd bypass. Cther lead connects to center terminal of PTT jack.

11.) Using a quarter wavelength of single conductor wire for the offending band or bands, connect as a counterpoise to the ground lug of the antenna tuner, power supply, or transceiver. Do not coil, but effectively loop this counterpoise along the rear apron area of equipment. Do not connect other end to ground or any other terminal.

12.) Place a .01 mfd capacitor from the hot mike input to the adjacent ground pin on the VOX Board 80230.

TEN-TEC INSTRUCTION SHEET
MODELS 282, 285 and 288 CRYSTAL FILTERS

GENERAL

Models 282, 285 and 288 are 6.3 MHz crystal ladder filter options designed for use in the DELTA and CORSAIR transceivers.

SPECIFICATIONS

	Model 282	Model 285	Model 288
CENTER FREQUENCY, MHz.	6.299250	6.299250	6.300
6 DB. BANDWIDTH, Hz.	250 NOMINAL	500 NOMINAL	1800
SHAPE FACTOR, 6/60 dB.	3.4:1	2.9:1	1.75:1
INSERTION LOSS, dB	11.5	5.5	2.5
ULTIMATE, REJECTION, dB	+90	+90	+100
Z_{in}, Z_{out}, OHMS	200	200	200

INSTALLATION - CORSAIR TRANSCEIVERS

1.) Turn power off. Remove four screws securing top cover and remove it.

2.) Locate the PBT Board 80979. LOCATE the socket for the filter being installed.

3.) MODEL 288 ONLY: locate the short gray jumper wire in the middle of the 1.8 socket, and cut it off flush with the board at each end.

4.) Carefully align the four pins of filter with the corresponding sockets on the board and gently push down until each pin seats in its socket. NOTE: There is no IN or OUT orientation to the filter; it may be inserted into its socket either way.

5.) Turn power back on and check for proper filter operation. Make sure the transceiver "receives" in the XTAL switch position associated with the filter just installed. If not, check that the filter is seated in its correct socket.

6.) Replace top cover and 4 screws.

INSTALLATION - DELTA TRANSCEIVERS

1.) Turn power off. Remove the four top cover screws and remove top cover.

2.) Locate the IF Amplifier Board 80554 directly in front of the final amplifier assembly. A GREEN jumper wire runs diagonally across the board.

3.) Remove GREEN jumper wire by cutting it off flush with the board at each end.

4.) Carefully align the four pins on the crystal filter being installed with the corresponding sockets on the board and gently push down until each pin seats in its socket. NOTE: There is no IN or OUT orientation to the filter. It may be inserted into its socket either way.

5.) Turn power on and check for proper filter operation. Make sure the DELTA "receives" in the CW-1 switch position. If not, make sure the filter is seated in its socket.

6.) Replace top cover.

OPERATION - CORSAIR TRANSCEIVER

When one of the optional filters has been installed on the PBT board, it can be selected by the XTAL switch on the front panel. It will become part of the passband tuning system.

OPERATION - DELTA TRANSCEIVER

When one of the optional crystal filters has been installed on the IF Amplifier board, it can be selected for use in cascade with the 2.4 kHz standard filter with the SELECTIVITY switch on the front panel. The optional filter will be active in the CW-1 and CW-2 positions only.

TEN-TEC

OWNER'S MANUAL

Model 280

TEN-TEC MODEL 280 POWER SUPPLY

GENERAL

The TEN-TEC Model 280 Power Supply is designed to deliver 18A at 13.5V from a 115 or 230 vac 50-60 Hz source. An electronic latching circuit breaker shuts off the output voltage when the current drawn from the supply exceeds 20 amperes. When this breaker trips, the meter lamp goes out indicating loss of output. The breaker is reset by cycling the POWER switch from ON to OFF and back to ON. The primary circuit is fused with a 4 ampere fuse on 115 vac and 2 ampere fuse when wired for 230 vac. The output voltage is available through a four pin AMP connector at the end of a three foot power cord and at two phono type jacks for low current applications. The center two of the four AMP pins are used for remote power on-off switching, if desired. The front panel meter indicates current drawn.

The circuit consists of a bridge rectifier followed by a high capacitance filter. This in turn, is followed by two parallel transistors in a series regulator circuit whose base voltage is derived from an integrated circuit regulator and driver transistor. The circuit breaker consists of a SCR latching circuit which turns off the regulator when the current drawn exceeds the set limit. The SCR triggering signal is developed across a pair of low value resistors in series with the output, which also serve to assure sharing of the load current between the two pass transistors. Overvoltage protection of the output is provided by a SCR "Crow-Bar" circuit which short circuits the output if it should rise above 16 VDC.

INSTALLATION

Output Cable and Connectors: The high current output should be drawn from the four pin AMP connector at the end of the output cable. Pin 1 is GND (black) negative, and identified by the rib on the plastic shell of the output connector. Pins 2 and 3 (white) are connected in series with the front panel POWER switch and are used with a remote on-off switch, if desired. Pin 4 is +13.5 volts (red).

If the supply is to be turned on and off only by the front panel switch, pins 2 and 3 should be jumpered together at the connector or where the two white wires attach to the terminal strip inside the unit. Keep interconnecting cables carrying high current as short as possible and of a wire guage greater than or equal to #14. Sizable cable voltage drop will be experienced if too long or if a small wire size is used.

Provide a good interchassis connection by running a separate heavy braid or stranded wire between them, using the ground lugs provided on the rear panels. In rf communication systems, a connection from chassis to a good earth ground is also recommended.

The phono jacks marked AUX 12V are connected in parallel with the output from the AMP socket and may be used to power auxiliary equipment that does not draw more than five amperes. Center terminal is positive, shell is negative.

The power transformer has a dual primary winding permitting operation on either 115 or 230 vac. As supplied, it is factory wired and fused for 115 vac. To change from 115 vac to 230 vac, the primary must be rewired using the wire nuts supplied and the fuse must be changed to 2A slo-blo (also supplied). See paragraph 9 of the OPERATION section.

OPERATION

1.) Connect the line cord to proper source of voltage. This is a three wire cable and the green center conductor should be connected to the main ground system. It is internally connected to the supply chassis.

2.) Connect load to AMP connector as described above.

3.) Turn unit on by pressing the top protruding edge of the POWER switch. The meter lamp should indicate that output voltage is present. If the lamp does not light, check load and cables for short circuit or excessive current situation.

4.) The lamp illuminating the current meter is powered from the regulated output of the supply and should not dim with current loads up to the rated output. If pilot lamps in the driven equipment dim with increased load current, but the current meter lamp stays constant, it is an indication that a loss of voltage is occuring in the interconnecting cables or connectors. To remedy use shorter cable and/or larger wire size.

5.) To reset the circuit breaker after it has shut down the output voltage as indicated by the meter lamp, turn the unit off and back on again. If the short or overload remains, the breaker will again shut down. Remove the cause of overload and reset again as before.

6.) If for some reason the crow-bar circuit should detect an over-voltage condition it will short the output voltage. If this was caused by a transient spike, the circuit breaker will trip out and must be reset as above. If the overvoltage condition is the result of a component failure, or the overcurrent breaker is inoperative, the internal 20 ampere fuse will open and reset will not be possible. If the internal fuse blows (mounted in fuse clips located on the heatsink circuit board), it indicates that some internal part has failed and service is required.

7.) Fuses: In the event that the line fuse blows, replace it with an identical type slo-blo. The line fuse holder is located on the rear panel next to the line cord strain bushing.

for 115 vac operation:	4A	SLO-BLO	Type MDL-4
for 230 vac operation:	2A	SLO-BLO	Type MDL-2

NOTE: The unit is wired at the factory for 115 vac operation. If 230 vac operation is desired, the transformer primary and the fuse must be changed per the instructions in section 9 below. Failure to do this will result in serious damage to the unit.

8.) Do not place the power supply in a closed area or in a small space where normal room air cannot circulate freely around the heat sink on the rear panel. This heat sink should have free access to normal air convection currents. For instance, do not place the supply on the floor in a corner. If this is the only available location, turn it around--fins out. Always operate the supply with the heat sink and fins vertical. Never put anything on top of the heat sink fins.

When operating near full load for relatively long periods of time, the heat sink will become quite hot. The bottom pan of the chassis will also become hot due to power dissipation in the bridge rectifier. The large heat sink is capable of maintaining this type of operation if the free air circulation requirements as above are met. If extended operation is anticipated, and/or the line voltage is above the mean values of 117 or 230, it's recommended that a small fan be used to circulate air around the heat sink. For normal cw or ssb Amateur applications, where the duty cycle is less than 60%, a fan should not be necessary. If there is any question as to whether there is enough air circulation around the heat sink, check the temperature of the heat sink. It should not be allowed to go above 100°C or 212°F. To do this, moisten the tip of your finger and touch lightly near one of the transistors on the heat sink. If it sizzles, its too hot.

9.) OPERATING VOLTAGE. The Model 280 is factory wired for 115 vac operation. To change for 230 vac operation: 1. Remove the top, locate the two yellow wire nuts securing the primary wires. 2. Remove the wire nut from the connection containing the RED wire, remove the RED wire and then replace the wire nut. 3. Remove the other wire nut, untwist the BLUE wire and replace the wire nut. 4. Using the spare wire nut from the accessory pack, twist the RED and BLUE wires together. 5. Replace the 4A line fuse with the 2A fuse in the accessory package.

SPECIFICATIONS

Input Voltage: 105-125 vac, 50-60 Hz or 210-250 vac, 50-60 Hz.
Output Voltage: 13.5 vdc, adjustable 12.5 to 14.0 vdc.
Regulation: Better than 1% no load to full load @ 117 vdc.

Output Current: 18 amperes, full load, 20 amperes, maximum.
Circuit Breaker: Electronic latching. Factory set at 20A.
Panel Meter: 0-25 amperes.
Ripple: Less than 60 mV peak-to-peak at 18A at 117 vac.
Construction: 16 ga. aluminum chassis and top.
Output Connectors: One 4 pin AMP MATE-N-LOC, two phono jacks for low current.
Size: HWD 5½" x 7" x 12"
Weight: 15 lbs.

CIRCUIT DESCRIPTION

Model 280 Power Supply uses a series regulator type circuit incorporating two 2N5301's as the pass elements. While either transistor could handle the 20A of output by itself, two are used with a generous heat sink to assure plenty of design margin. The .15 ohm resistors in each emitter assures that the load is equally shared between the two pass transistors. They are also used as the meter shunt and sense element for the over-current breaker.

The circuitry is divided into three assemblies. The chassis contains the transformer and associated ac wiring, bridge rectifier, and filter capacitor. The regulator board contains all the control and drive circuitry. The pass transistor assembly is mounted on the rear heat sink and contains the pass transistors, shunt resistors and the overvoltage crow-bar and its fuse. For ease of service, these three assemblies are interconnected with cable plugs where current requirements permit.

REGULATOR BOARD

The heart of the Model 280 is a 723 integrated circuit voltage regulator. It contains a stable reference voltage source, feedback amplifier, over current shut-down, and control circuits. The regulator board by itself is a 1 ampere current limited power supply and is used to drive the pass transistors on the heat sink for the required current output. The current sense voltage from the pass transistor board is returned to the regulator board between pins E and O. This signal is used to drive the output current meter and the over current breaker. Potentiometer R7 sets the meter calibration and R10 sets the current trip point. Output voltage is adjusted by R12.

The regulator board has its own rectifier and filter capacitor. Diode D3 and capacitor C2 supply the hold-in current for SCR Q2 when the over current circuit trips.

As received from the factory, the potentiometers are carefully adjusted for the following settings:

METER	Calibrated at 15A.
VOLTAGE	Set for 13.5V
TRIP	Set for 20A.

These should not require further adjustment unless service has been performed on the unit.

PASS TRANSISTOR BOARD

This board contains the series pass transistors. The two 2N5301 transistors are connected in parallel with the ballast resistors on each emitter. These resistors insure that the two transistors share the load current and also are used as current sensing shunts for both the meter and current trip currents.

The crow-bar circuit occupies one corner of the board. If the output voltage should rise above 16 vdc, zener diode D1 will conduct and apply forward bias to the gate of SCR Q3. When Q3 latches, it shorts the supply output to ground, which will either cause the over-current circuit to trip or will blow F1, the 20A fuse.

IN CASE OF DIFFICULTY:

SYMPTOM	POSSIBLE CAUSE
No output when turned on (meter dark)	External AC switch not on. (switch between white wires of output cable) Line fuse blown
No output but meter jumps at turn on	Output shorted
Output voltage sags with load (meter lamp dims)	Low line voltage Blown 20A fuse
Blown 20A fuse	Shorted pass transistor or accidental ground wire contact to transistor case on heat sink.

VOLTAGE READINGS---PASS TRANSISTOR BOARD

	C (a)	B (g)	E (cath)	
Q1	24.5	14.2	13.5	
Q2	24.5	14.2	13.5	no load, untripped
Q3	13.5	0	0	
Q1	24.5	0	0	
Q2	24.5	0	0	tripped due to overcurrent breaker
Q3	0	0	0	

VOLTAGE READINGS---REGULATOR BOARD

(No load)

U1 Pin	723 Volt	I.C. Pin	Volt
1	NC	14	NC
2	14.2	13	16.0
3	14.2	12	24.5
4	7.1	11	24.5
5	7.1	10	14.8
6	7.1	9	NC
7	0	8	NC

NC=No Connection

PIN--INNER CONNECTION SOCKETS

B (case)	14.2
E (emitter)	13.5
O (output)	13.5
M (meter)	13.5

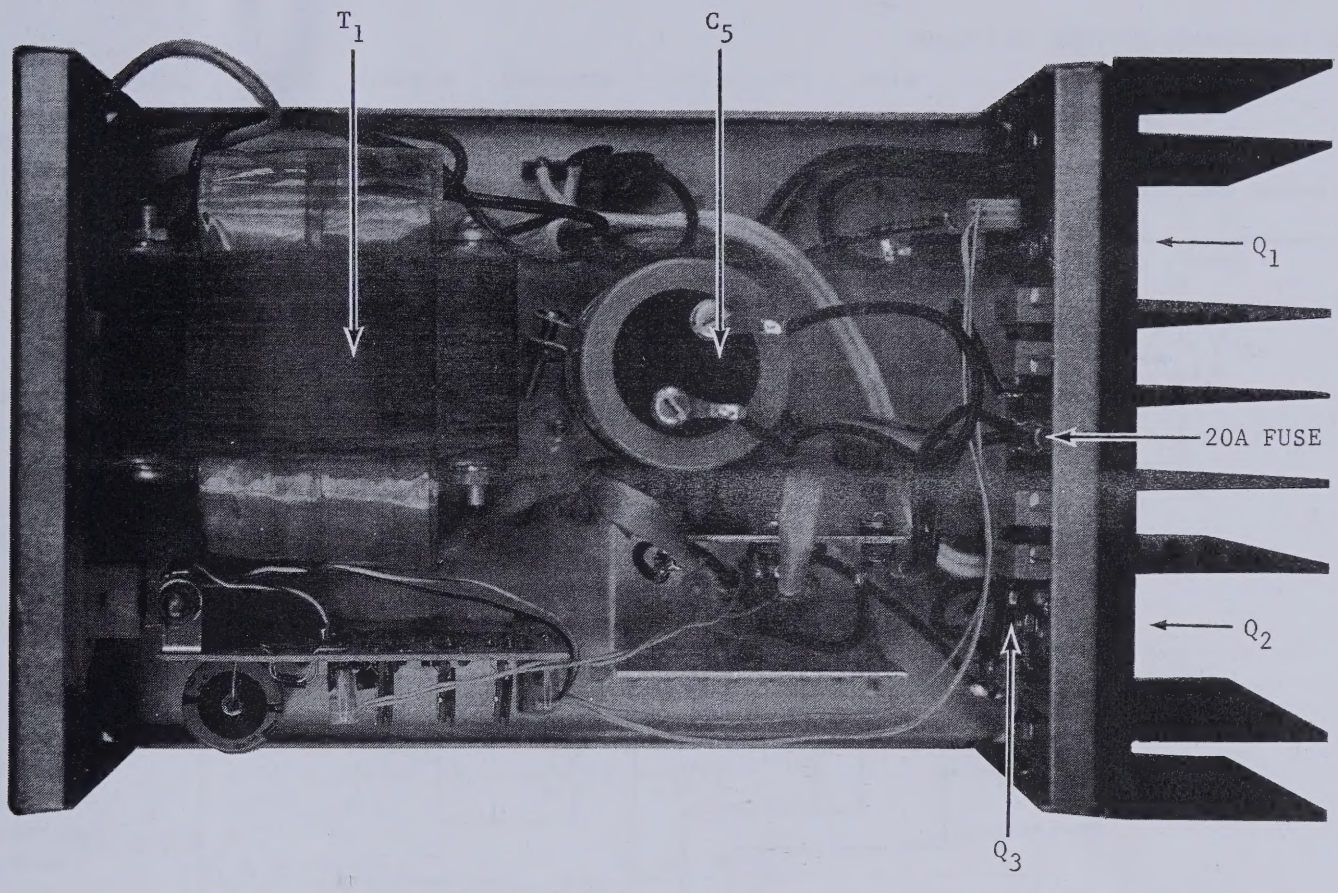
AC--18 vac
Transistors (scr)

NO LOAD

	C (A)	B (G)	E (cath)
Q1	24.5	14.8	14.2
Q2	24.5	0	0
Q3	0	13.5	13.5

Tripped by overcurrent

Q1	24.6	.45	.45
Q2	.7	.75	0
Q3	.5	0	0



REGULATOR BOARD

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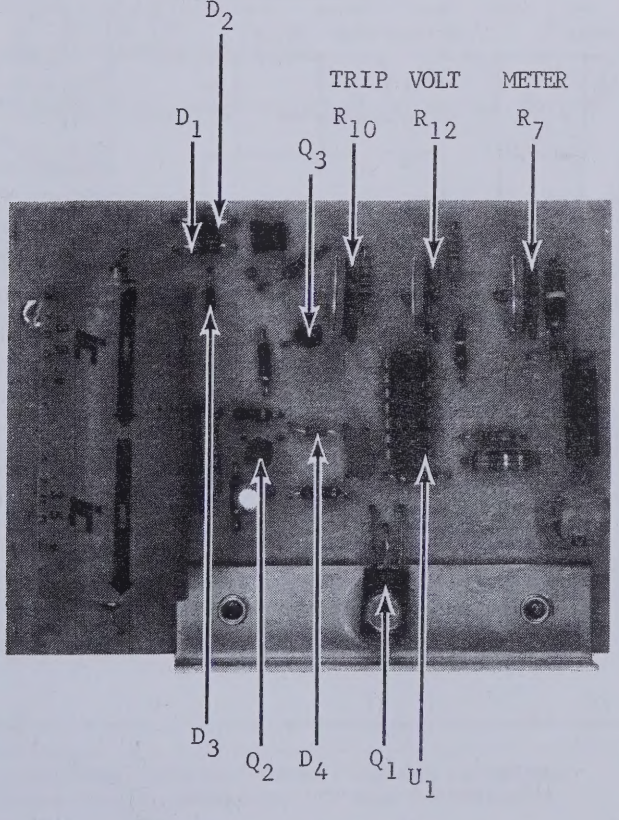

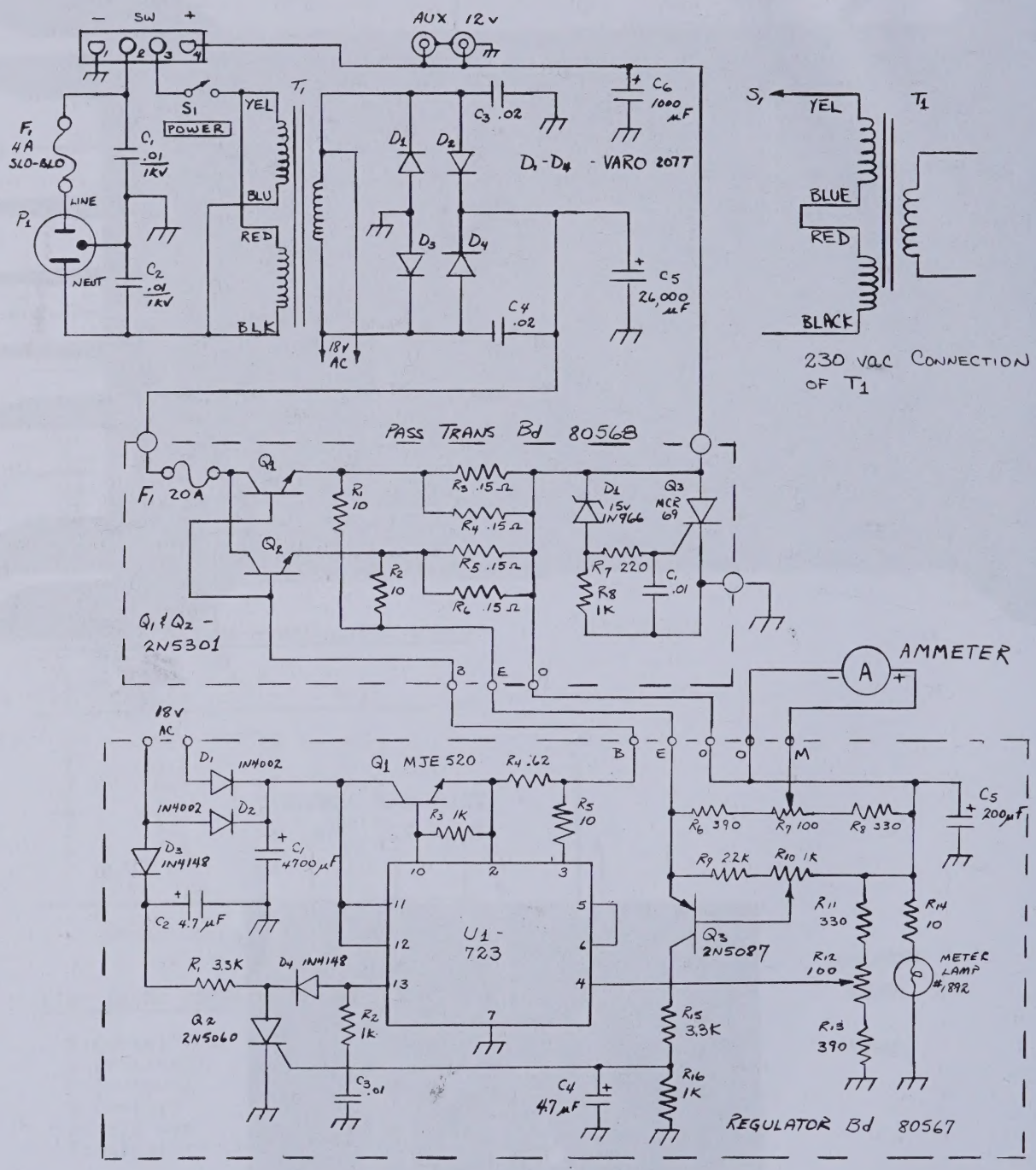

MODEL 280 POWER SUPPLY

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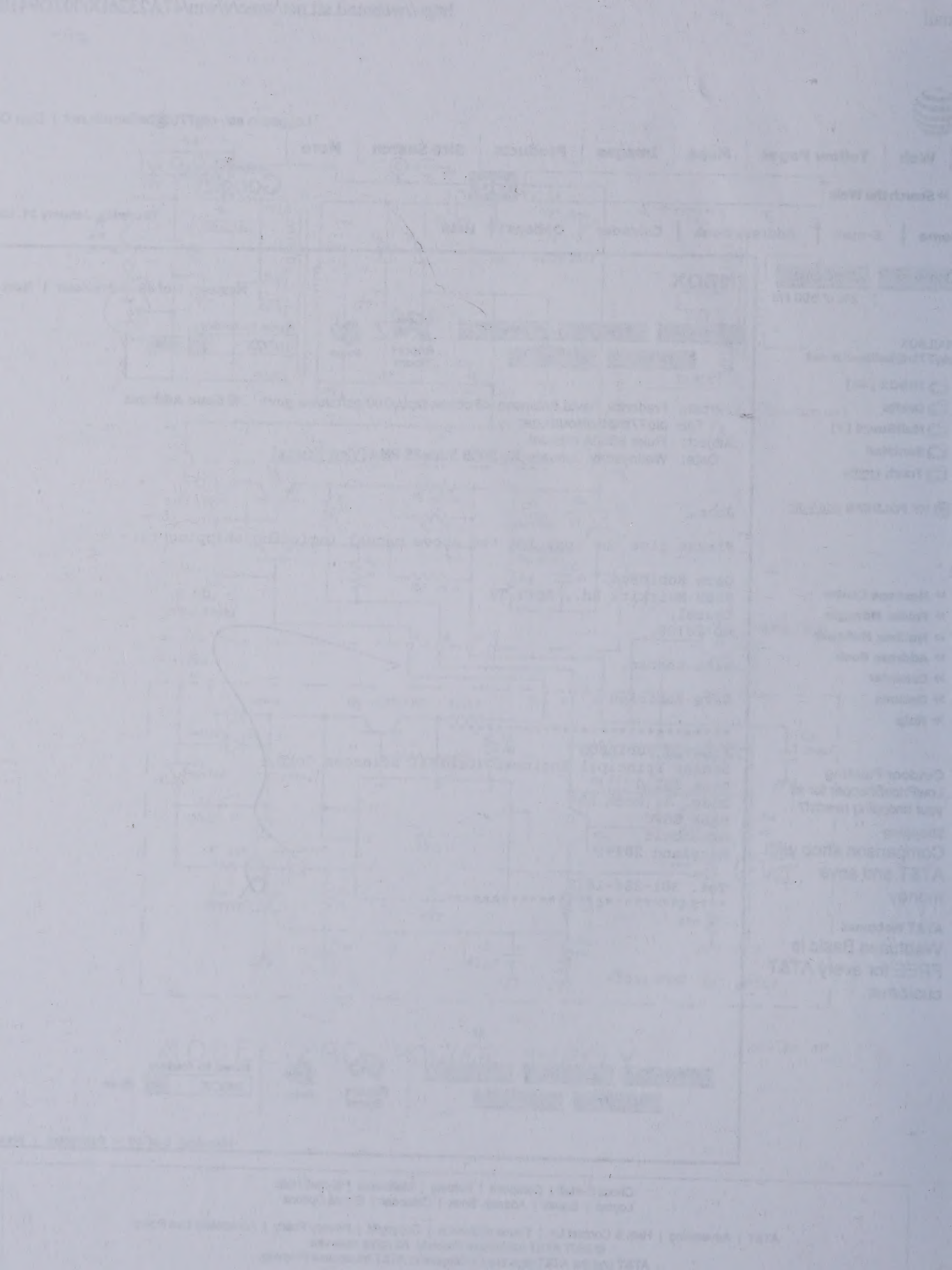
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